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June 1948 · 25c

Your Back-Yard Resort

PAGE 74

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Beams and Floor Joists
Building Materials
Types of Lumber
Roofing Materials—Asphalt, Asbestos, Aluminum, Wood Shingles
Concrete forms, mixing
How to Make All Types of Tinsmith Repairs

INTERIOR REPAIRS
Repairing Creaky Floors
Repairing and Storing Screens
Repairing Windows—sash cord, windowpanes; loosening stuck windows
Linoleum-laying, patching
Fixing Loose Tiles
Mending China, Metal Utensils
Repairing Door Locks, Hinges
Fire Fighting Equipment
Basement into Game Room
Building Partitions
Laying Hardwood Flooring, etc.

DECORATING
Wallpapering
Cleaning Wallpaper
Cleaning Painted Walls
Repairing Plaster
Scraping Floors
Refinishing Floors
Care of Carpets and Draperies

PAINTS AND PAINTING
Types of Paint Brushes
Types of Paint
Varnishes, Enamels
Lacquers, Shellac
Calcimine
Paint Thinners
Mixing Paints
Surface Preparation
Removing Paint
Painting a New Surface
Porch Floors and Steps
Painting Metal
Preparing Plaster
Fillers, Staining, etc.

(Above) A simple little trick like knotting the wire inside extension plugs can save you severe burns, blown-out fuses, and fire hazards. Protect your home and family with the advice in this book!

ELECTRICITY IN THE HOME
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Home Generators
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Appliance and Extension Cords
Replacing Fixture Sockets
Electric Motors
Home Signalling Systems
Burglar Alarms, etc.

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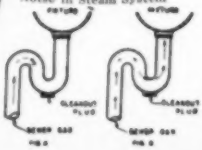
Coal Furnaces, Oil Burners
Automatic Draft Regulators
Thermostats
Fuel Economy
Warm Air Heating Systems
Steam Heating Systems
Cleaning, Adjusting Radiators
Noise in Steam System



Hot Water Heating System
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Cleaning Boilers
Cleaning the Furnace
How to Insulate Your House
How to Build and Install Storm Windows
Efficient Weather Stripping, etc.

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Water Supply
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Cesspools, Septic Tanks
Stopped Up Sewer Pipes
Stopped Up Drains
Chemical Drain Cleaners
Plumbing Traps
Noisy Plumbing
Repairing Hot Water Tanks
Thawing Frozen Pipes
Water Softening Equipment
Repairing Faucets, Flush Tanks, Leaky Pipes, etc.

EXTERIOR REPAIRS
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Waterproofing Masonry Walls
Repairing Cracks in Foundation, Stucco Walls
Repairing Brick Walls
Repairing Leaky Roofs
Caulking Seams
Gutters and Downspouts
Ridding the House of Termites, etc.

YOUR GARDEN
Building Garden Paths
Building Garden Pool
Care and Use of Garden Tools
Cold Frames
Rustic Screens and Arches
Building an Outdoor Fireplace
Erecting Garage, Summer Guest House or Play House in Garden, etc.

Learn the correct way to care for brushes, tools, etc., to make them work better and last longer. This information in the book saves you money.

(Left) You SEE diagrams that help you locate and, with little effort, fix plumbing noises, leaks, and drain stoppages.

OWN HANDYMAN!

Here's Everything You Need to Know to Do Your Own Repairing, Beautifying, Modernizing, Converting! The A to Z of CARPENTRY, PLUMBING, PAINTING, DECORATING, WIRING AND APPLIANCES, MASONRY, FURNITURE REPAIR, HEATING SYSTEMS—*all in one book!*

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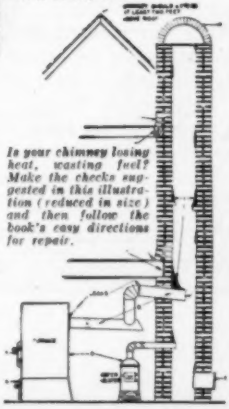
(Left) Furniture upholstery and repair is a fascinating and money-saving hobby when you follow the easy step-by-step instructions in this book.



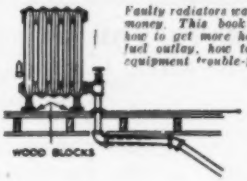
In your chimney losing heat, wasting fuel? Make the checks suggested in this illustration (reduced in size) and then follow the book's easy directions for repair.

FURNITURE CARE AND REPAIR

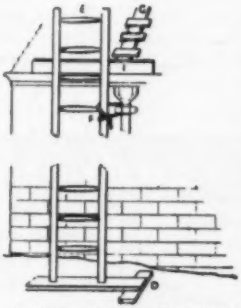
Upholstery of Chairs, Sofas, etc.
Replacing Worn Springs
Strengthening Frame
Furniture Upkeep, Cleaning, Removing Water Stains, Marks, Scratches, etc.
Loose Joints
Broken Chairs
Polishes and Polishing
Staining, etc.

YOUR TOOL KIT

Equipping Your Workshop
Selecting the Right Tools
Correct Use of Tools
Care of Tools
How to Sharpen Tools
Sandpapers, Glues, etc.
Soldering Equipment and Technique



Faulty radiators waste heat and money. This book shows you how to get more heat for your fuel outlay, how to keep your equipment trouble-free.



Avoid hazards. This illustration shows how to secure a ladder when you make roof repairs. Complete instructions for repairing walls, foundations, gutters, shingles, etc.

How to equip a workshop, how to use all types of tools, how to use sandpaper and glues—all are fully covered in this "show-me-how" volume.

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CONTENTS FOR JUNE, 1948

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Science News

New Floating Bearing..... 82
Magnetic Oil Holds New Clutch Tight.... 83
Rockets Carry the Mail..... 88
Secret Sea Peak Found..... 96
Planes Race Past Sound.. 102
Army Grows Biggest Crystal.....112
Cable-Eating Gophers Foiled at Last....127
Gas Pipe Takes to Air.....134
Streamlining Speeds New Subs.....135
Makes More X Rays.....143
More Power, Less Fuel.....144

Science at Work

"Boots" Protect Bridges..... 96
Sniffs Gas Leaks.....113
Ship-Hider Fights Bugs.....113
Porcelain Skin Protects Prefab.....114
How a Vacuum Coffee Maker Works....125
Mill Rolls Steel at 70 Miles an Hour.....139

PS Features

Help Yourself to a Back-Yard Resort.... 74
Train Space at a Glance..... 90
Seven-League Hands for Hot Atoms..... 91
Office Goes Up and Down.....100
It Pays to Know Your Wallpaper.....106
Cartoons Teach Physics with a Smile....126
Top Scientist Has His Own Shop.....128
New Phonograph Runs Itself All Day....132
Curb Bank Uses Mirrors.....134
Arctic Mine Yields Atom Ore.....136
Gravity Aids Grocers.....138
Model Engine Handles Real Logs.....166
Buying Packaged Breezes for Summer....168
You Can't Destroy Energy.....210

Aviation

Going Up in Smoke..... 73
What's New in Aviation..... 86
Lamps Signal Danger..... 90
Plane Antennas Go Into Hiding.....111
Jet Goes to College.....118
New Jet Hits the Deck For U. S. Navy..121
Guillotine Cuts Planes.....134
B-29 Lays Biggest Egg.....138
Egg-Beaters Try Jet.....144

Automobiles

New Bus Built for Comfort.....101
Rocker-Beam Engine in Motorcycle.....145
Hints from the Model Garage.....146
Gus Troubleshoots by Ear.....148
Patch Up Your Car with Cloth.....152
Homemade Midget Car for Three.....154
Seat Covers of Plastic Yarn.....188
Filter Has Replaceable Screen.....188
Mechanic's Light Fits on Head.....212
Spring Limits Speed of Car.....216

This mark in text indicates Trade Name.

Continued on page 4

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Inventions

Handle Fits Your Hand.....105
New Ideas From the Inventors.....116
Robot Cleans, Paints, Dries.....119

Photography

Photos Print on Cloth..... 82
World's Fastest Camera.....143
Camera on Broom Shoots a Strike.....190
Photo Ideas And Equipment.....191
Darkroom Built in a Closet.....192
Mining Silver in Your Darkroom.....206

Mechanics & Shopwork

"Workhorse" Carries Your Tools.....159
Post Lamps to Mark Your Drive.....160
Line Spacer for Drafting.....176
Hand Beveling and Chamfering.....178
T-Square Rolls on Gears.....183
"Faceplate" Aids Lathe Milling.....184
Making Your Own Rotary Planer.....185
Pipe Seals Garage Doors.....208
Acid-Core Solder Is Leakproof.....212
Two Clamps Make a Big One.....213
Chalk Used as Soldering Mask.....215
Gears Work Offset Screwdriver.....216

Home Mechanics & Handicraft

Action Station for Small Fry.....156
Wire-Grille Doors on Cabinet.....164
Hanging Hurricane Lamp.....167
Furniture From the Forest.....173
Ebony and Plastic Pipe Rack.....176
Lace Design Cut in Candy Plate.....177
Chess Ashtray is Hand Carved.....201
Models Duplicate Real Houses.....202
Heat Repairs Plastic Toys.....203
Insulation Reflects Radiant Heat.....213
Tray Increases Scale Capacity.....214
Hidden Attic Stairs Fold Up.....215
Chisel Rack Protects Edges.....216

Radio & Electricity

How You'll See a President Nominated.. 97
Television Images Magnified.....194
Felt Pads Stop Record Slip.....194
News in Electronics.....195
How to Buy Radio Parts.....196
Electronic Timer Checks Racers.....212

Departments

Letters 16
Voice of Science..... 71
I'd Like to See Them Make.....120
What's Your Ingenuity Quotient?.....161
Aids to Modern Living.....162
New Tools.....182
New Shop Ideas.....186
Craftsmen at Work.....189
Keeping the Home Shipshape.....204
Gadgets for Play Hours.....209
Editorial Memo.....286

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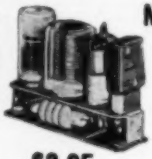

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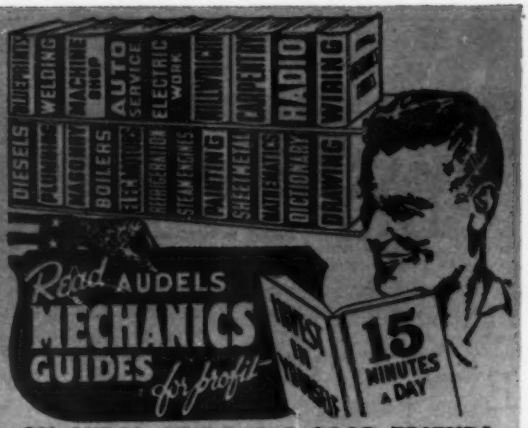

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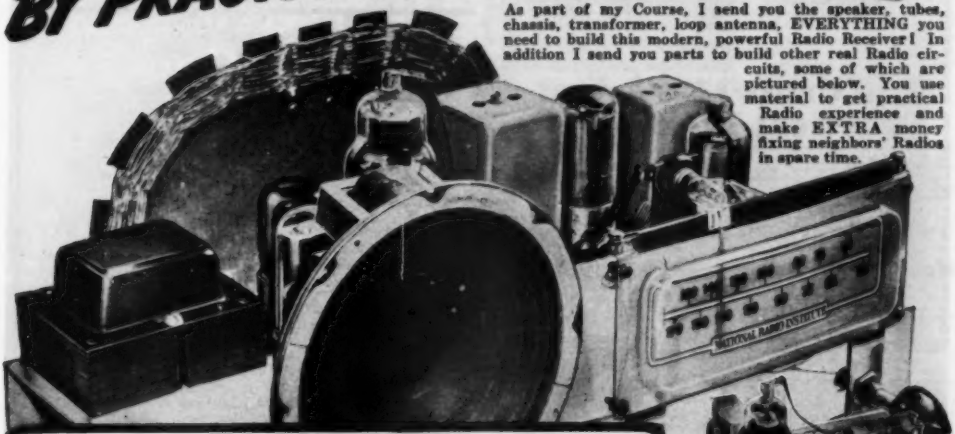

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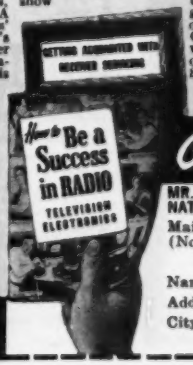

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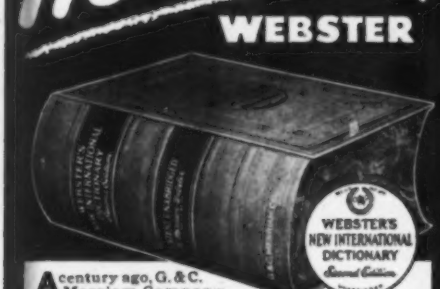

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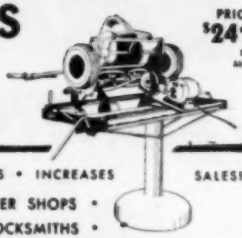

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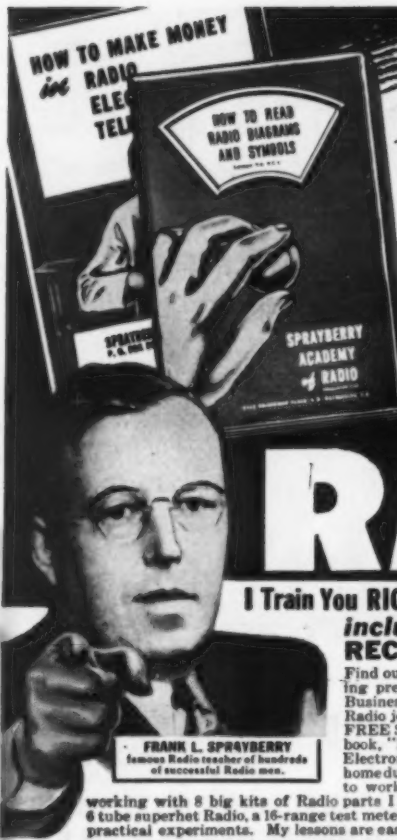

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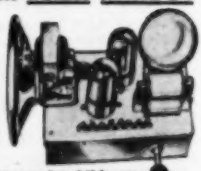

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Letters

"Why Hurry for that Harp?"

Sir:

The article "Good Driving Is a Habit" by Devon Francis and John F. Stearns in the March issue is excellent. The so-called illustrated statistic on the front cover and the two pages of colored pictures showing troublemakers should cause a lot of serious thinking.

Best of all we liked the Seven Keys to Safety but feel that two more keys could be added with excellent results. One is to know the meaning of the basic shapes of highway signs. It is surprising how many do not know these so that they may start compliance before they can read the lettering on the sign. The other suggestion would be simply to say that before crossing railroad tracks be certain the tracks are clear *both* ways.

These are important because each year an average of 1875 people are killed and 4700 injured because of collisions between trains and motor vehicles. . . .

D. E. Mumford
New York Central System
New York, N. Y.

In its recently published pamphlet on public safety—"Why be in a Hurry for that Harp?"—the New York Central sums up this good advice in the following three suggestions: "1. Heed the highway signs. They're there to help you—protect you! 2. Slow down for highway and railroad crossings—so that you can always stop, if necessary. You may never get a second chance. 3. At all railroad crossings, look and listen. Before starting across, be certain the tracks are clear both ways. Gambling with death is the poorest gamble in this world—and the quickest way to get into the next world. Don't be in a hurry for that harp! Lose a second and save a life—your life."

It Can Still Happen to You

Sir:

. . . You describe the cover illustration on the March issue as showing a situation comparable to a head-on collision at 30 m.p.h. To be sure, the car would be traveling 60 m.p.h. when it reached the ground,

INVENTORS

patent laws encourage the development of inventions

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The firm of McMorrow, Berman and Davidson is registered to practice before the U. S. Patent Office. Additionally, it maintains a staff of attorneys able to readily understand inventors' disclosures, to advise concerning patentability, and to prepare appropriate specifications and claims for filing with the Patent Office.

If an inventor believes he has an invention, a search of the most pertinent prior U. S. patents should be made and a report obtained relative to its patentability. Where such report indicates that the invention appears patentable, in order to secure protection, diligence should be exercised in making application for a patent.

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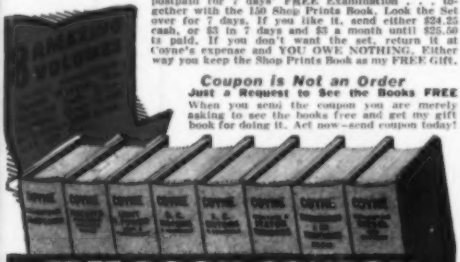

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and the actual speed of collision of the two cars would also be 60 m.p.h., but striking the ground, which is practically immovable, and striking another car are two different things. Actually a head-on collision at 30 m.p.h. is about the same as striking an immovable obstruction such as the ground at 30 m.p.h., for in each case the car's forward progress would be instantaneously stopped. . . .

So I suggest that your illustration shows a head-on collision at 60 m.p.h. for each car, while the 30-m.p.h. collision would be comparable to a 30-foot drop, about a three-story building.

. . . My desire to drive off a three-story building is little stronger than that for driving off one of nine stories, and looking at your picture makes me wonder if I ever want to drive 60 again, so even though in error it still makes a very good point.

RAYMOND C. THUROW

Madison, Wis.

Sir:

. . . May I suggest that your error may be in your conception of a collision? . . . If two cars . . . traveling at the same speeds in opposite directions collide, each car exerts the necessary equalizing force. Clearly two cars striking each other at a speed of 30 m.p.h. receive only as much damage as if they had hit a viaduct or fallen from 30.25 feet, or about three stories. . . .

HAROLD J. ANDERSON

Flint, Mich.

In its enthusiasm to make a point, PS was led slightly beyond the realm of ordinary physics. But even corrected figures don't make much difference—unless you figure you'll only be half as dead. Since most highway speeders operate closer to 60 m.p.h. than 30, PS's cover is still grimly realistic. Smashing into a car at 60 is the same as hurtling off a nine-story building—and who wants to do either?

Good Driving Gets Around

Sir:

. . . Praise to authors Devon Francis and John F. Stearns on their splendid article of safety, "Good Driving Is a Habit."

The Sacramento Police Department, Traffic Division, headed by Chief P. J. Bennett, asks permission to use part of this story and, if possible, to secure a cut, mat,

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or picture of the layout on "Seven Keys to Safety" that ran in this issue. It would be of immense aid for our local publicity in furthering our present traffic safety campaign which is now in effect. . . .

H. D. MEREDITH

Department of Police
Sacramento, Calif.

Sir:

I would like permission to reproduce some material from an article in the March issue of POPULAR SCIENCE for the benefit of drivers at this base.

The article is "Good Driving Is a Habit," by Devon Francis and John F. Stearns. . . .

SGT. CARL F. POMMER, USAF
Office of the Ground Safety Officer H. Q.
Fort Slocum, N. Y.

PS is proud to take part in such a worthy cause and is sending full reprint permission both to the Sacramento Police Department and Sergeant Pommer at Fort Slocum.

Common-Sense Science

Sir:

Just read the March, 1948, issue of PS. Leo Selty's letter, pages 18 and 20, was a stinker. I suppose, if he was working in a cramped space and his wrenches did not fit the bolts and nuts in a "properly applied manner," he'd leave the nuts loose. . . . Common sense should tell a man to use a wrench the way it fits best—using care not to strain it, the nut, or himself. . . .

T. E. DICKERSON, MM 3/c, USN
U. S. S. Fresno, New York, N. Y.

Galileo Right, PS Wrong

Sir:

Really, I'm surprised at you! In your February "I'd Like to See Them Make" page you accepted the suggestion that a weighted cap on a fountain pen would make the cap hit the floor first when dropped.

Since when has weight affected the velocity of a freely falling object? Velocity is the function of gravity acceleration and time only, omitting aerodynamics, which would be negligible in this case.

ROBERT KING

Inglewood, Calif.

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. . . Your magazine is supposed to be

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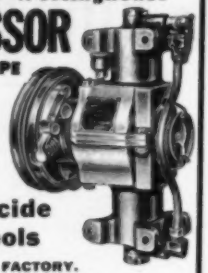

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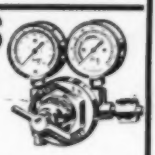

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scientific. . . . A rather stupid suggestion. . . . I'm just out of high school, but I know better than that. Watch it.

SANFORD ROBERTS

Oklahoma City

Sir:

. . . Unless Galileo was wrong, the fountain pen with the weighted end would break as many points as an ordinary one.

FRANK WELLS

Montgomery, Ala.

Sir:

Shame on you! Galileo proved it wouldn't work. . . . Perhaps the point saver would work if a parachute were attached. . . .

T. G. DALBY

Minneapolis, Minn.

No stranger to the Tower of Pisa, PS is the victim of a classic scientific mistake—an erroneous conclusion drawn from inaccurate experimentation. Some time was spent in dropping a pen with several ounces of wire solder wrapped around its cap. Since the tally showed an apparent tendency to spare the point, the item was published.

Just Between Bombers

Sir:

. . . The airplane that is being dismantled on page 168 of the March PS ("New Pans from Old Planes") is not an A-26 but a B-26, an old and very noble bomber. I flew many missions in this plane as a tail gunner.

S/SGT. STEVE M. NATHAN

St. John, Newfoundland

Your sharp eye is absolutely right. PS apologetically stands corrected.

Over-Simplification

Sir:

It was with great interest that I read your article on the hot-air engine in the February issue. I am puzzled by the simplified diagram on page 148. Is this drawing correct, or should the crank be shown at the top of the shaft?

W. HOLBROOK

Los Angeles, Calif.

The crank should be at the top. Combining different parts of two drawings resulted in this mechanical discrepancy.

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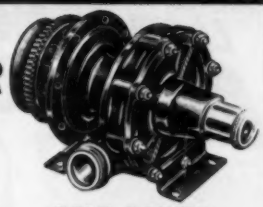

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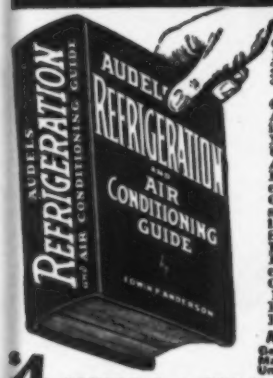

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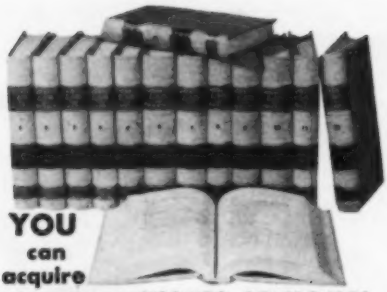

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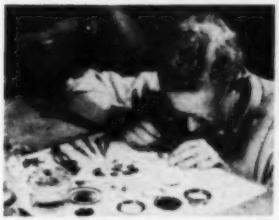

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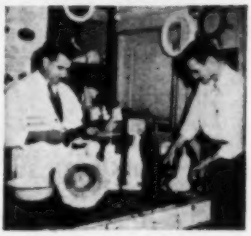

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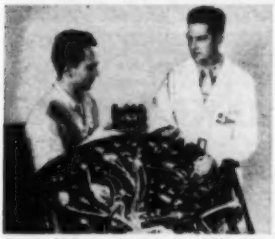

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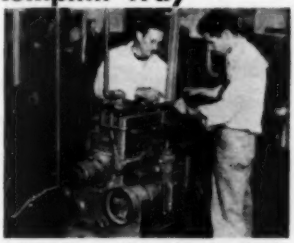

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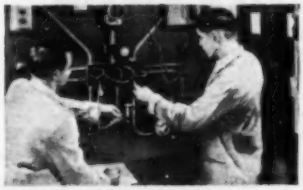

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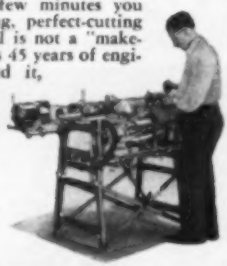

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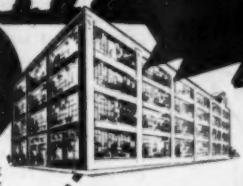

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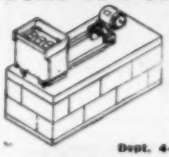

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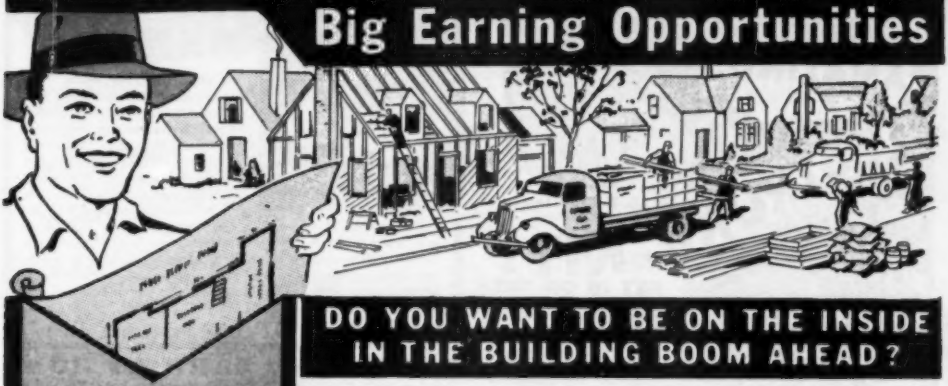

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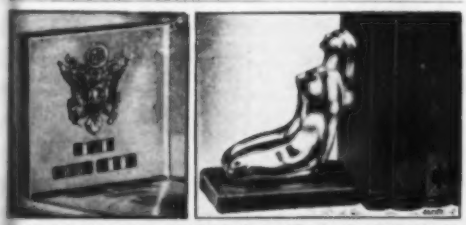

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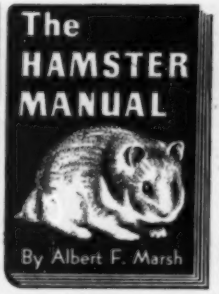

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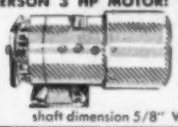

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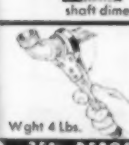

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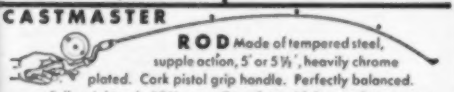

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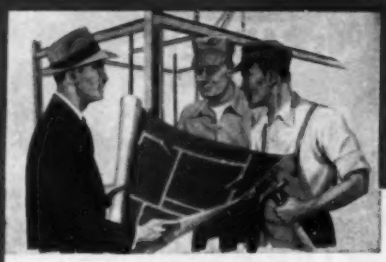

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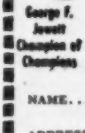

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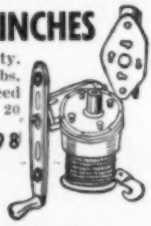

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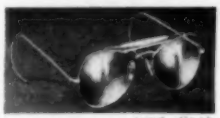

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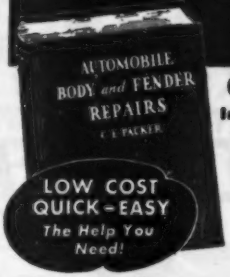

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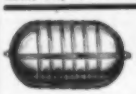

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56 BUSINESS OPPORTUNITIES

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57 MONEY MAKING OPPORTUNITIES

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61 HELP WANTED

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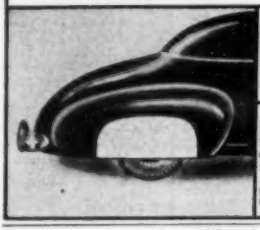

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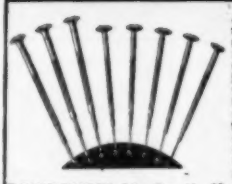

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ORDER TODAY—Mail check or money order—State Antenna desired. All prices postpaid or sent C.O.D. plus postage.

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Shopping by Television—a coming convenience

You know television as an exciting source of news and entertainment. But what about its many other uses?

250,000 people—at a demonstration arranged by RCA Victor—learned the advantages of "Shop-by-Television." Television receivers, located throughout a big store, showed customers what was going on in other departments . . . saved time, made shopping simpler.

88% of these customers said television was a major help . . . 62% said the program had drawn them to the store . . . more than half intended to visit departments where televised merchandise was sold. Sales of many televised items jumped 200% above normal!

Beyond its value *within* a store, "Shop-by-Television" is already reaching across the air waves to enter customers' homes. How convenient it will be to *see* merchandise on the screen of your RCA Victor television receiver, and then be able to do much of your shopping by telephone!

Progressive research leads to new uses for radio-electronic products and services, and to the quality you associate with the names RCA, and RCA Victor.

• • •

When in Radio City, New York, be sure to see the radio, television and electronic wonders at RCA Exhibition Hall, 36 West 49th Street. Free admission. Radio Corporation of America, RCA Building, Radio City, N. Y. 20.

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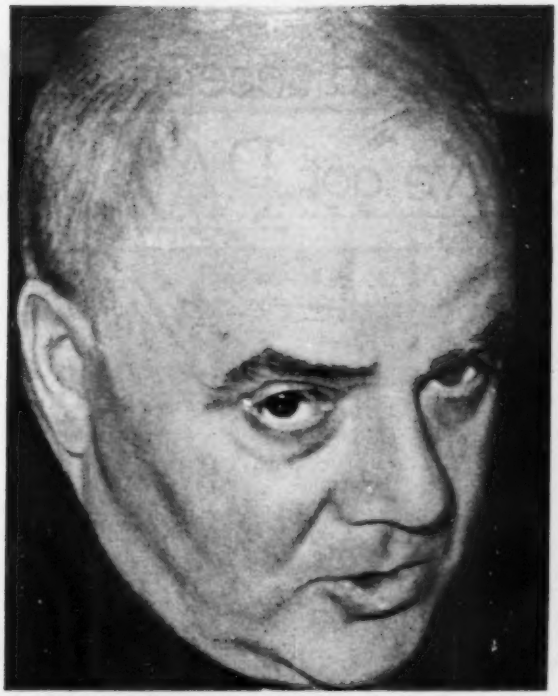

Chairman J. Parnell Thomas, House Committee on Un-American Activities.

PS
The Voice of Science

Don't Smear Science, Congressman!

THE Thomas Committee smear of Dr. Edward U. Condon won't help government recruiting of scientists. And Washington, up to our necks in science, already finds it hard to get the kind of men it needs for push-button peace.

Our government doesn't treat scientists too well anyway. First, we give them dirty and dangerous jobs—in the performance of which they can lose an eye, a hand, their lives, or their manhood. Or their reputation.

We pay them something less than they could make as chemists, physicists, or biologists in commercial enterprise.

Then we ask them, as patriots, to become slaves to secrecy. To live like slaves, under guard. To raise their families in slave quarters—some of which are nothing but government slums. And we ask them to keep secret any success they might have—success which might win them recognition or a raise in free enterprise.

These things they endure knowingly, as necessary to the high calling of their jobs.

Now, to the normal disadvantages of government service, J. Parnell Thomas has added the risk of Congressional displeasure. Of "investigations" which legalize libel. The threat of "the treatment"—a political technique which in effect suspends free speech and fair trial.

It was "the treatment" that finally broke down German science. For its impact is doubly fearful to the thoughtful men who will take their chances with the wild beasts of the laboratories, but who shrink from smirching publicity.

Dr. Condon can take care of himself in the Congressional clinches. But going into government service should not mean getting into the rough games of politics. The scientific mind can't laugh off the attacks of ambitious mediocrity.

If the Condon case is a sample of what scientists can expect in the service of our government, it is going to be harder to catch them and to keep them.

Perry Gilbreath

You're sure of a good reception when you've got P.A.*

The man with P.A. enjoys a good reception everywhere. He has Pipe Appeal—an extra attraction to the ladies. And when he has Prince Albert in his pipe—he's sure of extra enjoyment . . . real smoking joy and comfort.

P.A.* means Pipe Appeal
P.A. means Prince Albert

● Prince Albert has been getting a great reception from pipe smokers all over the country for years and years. They like P.A. because it's so rich tasting . . . so mild and tongue-easy. That choice crimp cut tobacco is specially treated to insure against tongue bite. Try P.A.—and see for yourself why it's America's largest-selling smoking tobacco!

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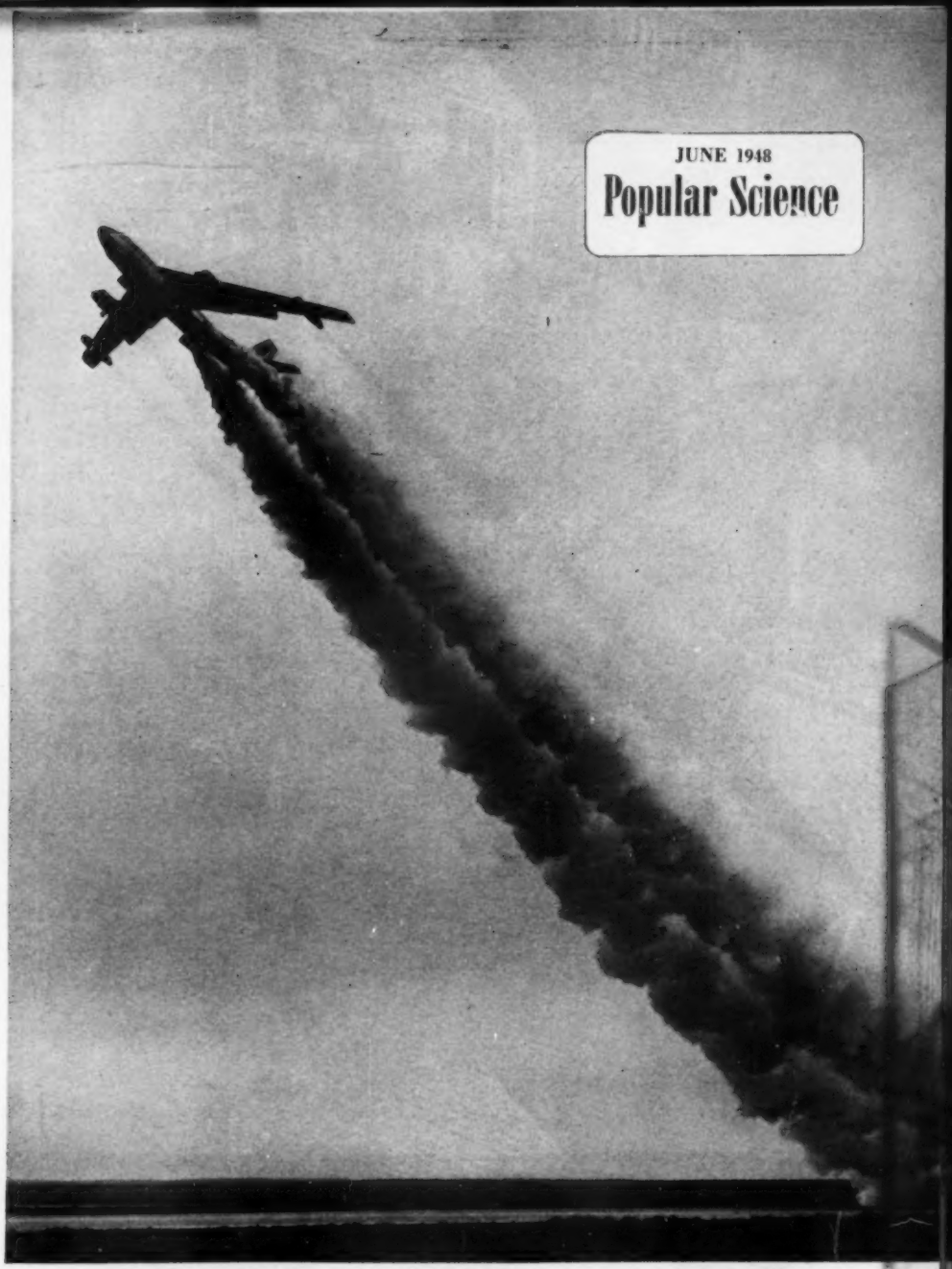
"GIVE ME P.A. FOR CIGARETTE MAKIN'S. IT'S CRIMP CUT. . . ROLLS UP FAST AND EASY!"

THE NATIONAL JOY SMOKE



Going Up in Smoke... Newest Air Force bomber is shot skyward by 42,000 pounds of thrust. It's the Boeing XB-47 Stratojet, and the curving smoke trails are streaming from 18 Jato rocket units. These rockets, nine on each side of the 108-foot fuselage, are used for heavy-load take-off and for emergency power. Normal power is supplied by six General Electric J-35 turbojet engines slung beneath the sweptback wings; each develops 4,000 pounds of thrust. Other performance characteristics of this new bomber are secret.

Main attractions of a summer vacation spot cost little more than your time—plus a bit of ingenuity.

Help Yourself to a Back-Yard Resort

By Arthur Bartlett

Drawings by Sigman-Ward and Ray Quigley

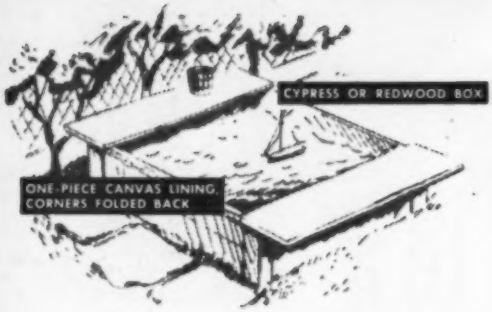
NOW is the time when millions of Americans are thinking of summer resorts. What will it be? Seashore? Mountains? Lake? Farm? Wherever you go, you can be pretty sure of one thing in advance: Your vacation will be all too short. You always come home wishing you could have a summer resort right in your own back yard all summer.

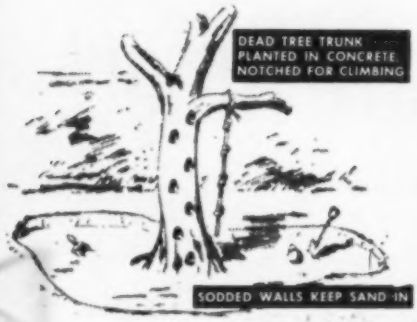
You can.

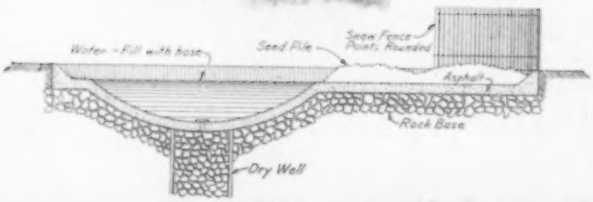
If you happen to be a millionaire, you just call in a landscape architect and a contractor and lay out an outdoor living room in the garden, a swimming pool and a tennis court, and maybe a polo field in the back forty. But you don't have to do it that way. You don't have to be a millionaire, and you don't have to have a big estate. All you need is the back yard, a few simple tools and supplies, and a little of that old American know-how. The cost can be whatever your pocketbook allows.

Most people putter around in their back yards, one way or another. Some have flower gardens, some build outdoor grills, some put up swings and seesaws for the children. What few people realize is that an ordinary back yard need not be just a place for Father to putter or for the children to

A little space, a few inexpensive materials – and a lot of ingenuity – provide the basic essentials of an outdoor summer resort at home: a place to play, equipment for cooking, tables, and screens.







PLAY

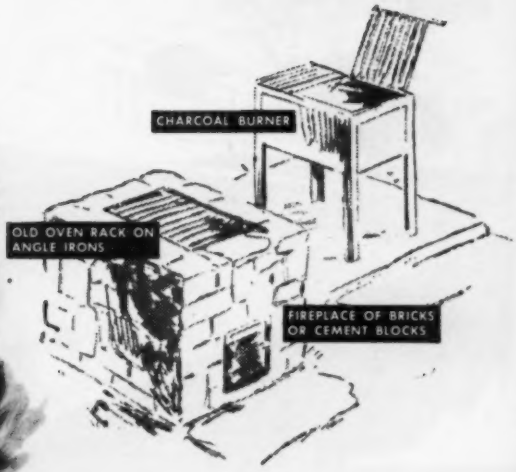
Recreation areas and equipment of their own help to keep youngsters out of the grownups' preserve. Drawing at lower right, with cross section underneath, shows a fairly elaborate, semi-segregated playground. Tips on simpler pools, and separate sand piles with safe gym apparatus, are sketched at left and top.

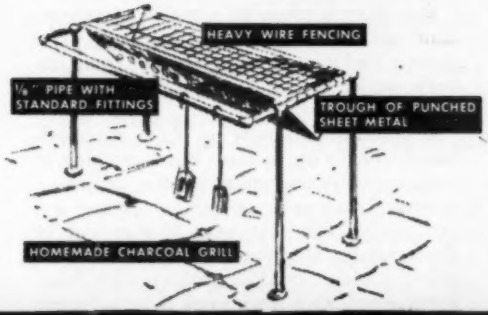
play, but can be a real, all-around summer resort for the whole family.

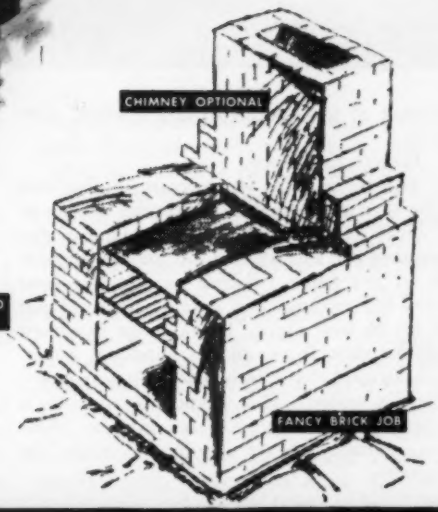
To prove this point, POPULAR SCIENCE asked me to analyze some typical summer resorts, and I waded through enough advertising literature to stock a travel agency. After boiling down to its simplest terms everything that the average summer resort has to offer, I can now report that you can have all the ingredients of a summer resort in your back yard with the aid of (1) a fence, (2) a cooking unit, (3) a platform, and (4) some water.

They form the basic resort pattern.

Of course, you can't move the ocean or a mountain into your back yard. For that matter, you can't go surf bathing at a mountain resort, or mountain climbing at the







COOKING

Outdoor stoves run the gamut of taste and cost from homemade charcoal grill to custom-built brick fireplace. Something in between is shown in the larger drawing. Since the rough-cut stones aren't mortared, it wouldn't need a foundation. Cooking rack is an old refrigerator shelf.

beach. But we are talking about the basic ingredients of a summer resort. No matter what kind of a resort you choose, you will find ways to relax and have fun, and they all fall into a definite, regular pattern. You can apply the same pattern to your own back yard.

Suppose, for instance, you have a small back yard, partly open to the street, or backed up to a neighbor's property, or exposed to a view of tin cans or something else that doesn't rate high among the beauties of nature.

Well, the first essential in the resort pattern is that it must be a place where you can relax in pleasant surroundings. You can't take sun baths, or lounge around in old or scanty attire, with curious people

staring at you—not with any comfort, any way.

Hence, the fence.

The fence gives you privacy, and it can also give you something pleasant to look at —which is part of the pattern. One of the simplest ways to achieve this double purpose is to get some colorful canvas—the kind used for awnings and deck chairs—and put it up on iron pipes. If you want to screen off the view from upstairs windows, a canvas awning, on a framework of iron pipes, can be added. This would also provide a shady spot, though for that purpose alone an ordinary beach umbrella might be enough.

Porch Shade or Vines as Screen

Another easy way to screen out prying eyes and unattractive sights is to use an ordinary split-bamboo porch shade, setting it up on its side, and attaching the ends to corner posts or to buildings.

Simple plantings make a particularly attractive screen, and do the job permanently —an evergreen or privet hedge, for instance, or a trellis or arbor with climbing vines or roses.

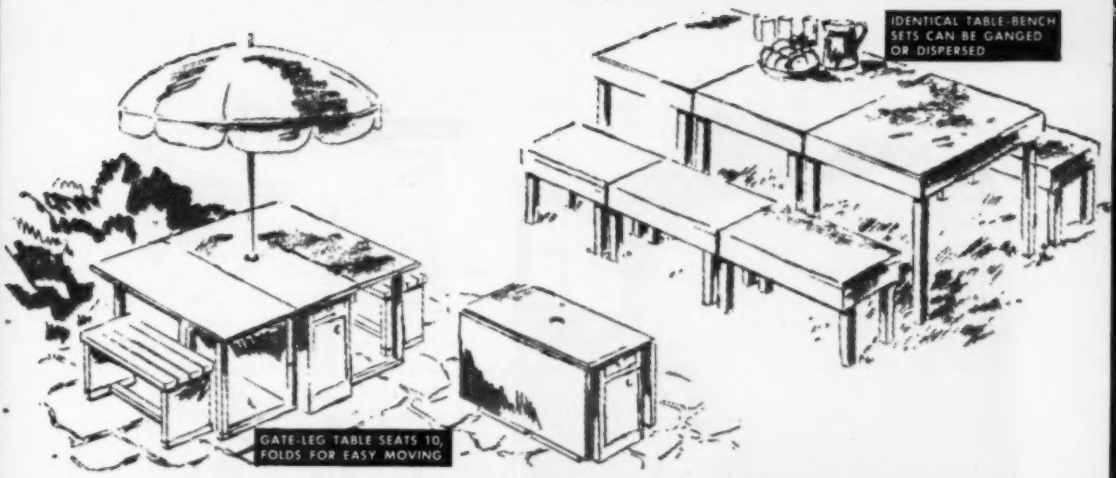
In a larger yard you can carry the screening a step farther, and divide one part of your resort from another. A split-bamboo or canvas screen can mark the bounds of the children's department, and leave the rest of the yard dedicated to peace and quiet. Or an attractively planted screen can enclose that part of yard which is to serve as an outdoor living room.

But there is more to a resort, of course, than just the external surroundings. The pattern includes pleasant change from the daily routine of life. That is where the cooking unit comes in.

It doesn't have to be an elaborate installation. That's up to you. But something to cook on outdoors makes all the difference between living as if you were at a resort and just plain living. It gets Mother out of the kitchen. It gives Father a chance to prove a man's outdoor artistry with hamburger—or with a thick steak if he is feeling flush. It makes a meal into a picnic for the youngsters. It makes the back yard, as the saying goes, a place to Get Away From It All.

POPULAR SCIENCE has published, from time to time, many suggestions and directions for building outdoor fireplaces and barbecues. Some of them are so simple that they take little more skill than being able to put one brick on top of another. If there happens to be a conveniently placed boulder in the yard, an adequate fireplace can be constructed simply by laying up stones or bricks against it, to form the sides, and putting a grill—a long-handled broiler or toaster, for instance—across the top.

You don't even have to go in for masonry



TABLES

If you want a table just for eating, take one of those above. They're light enough to move around and, with tops of waterproof plywood, can stay out in the rain. For more versatility there's the model on the opposite page, permanent but sturdy enough for games and sun bathing.

at all. A Wisconsin summer resort, as reported by POPULAR SCIENCE some years ago, used all-metal fireplaces made of 12-gauge steel, welded into a circular shape, with a cut-out opening for the fire door and concrete-reinforcing bars welded to the top to form a grate. Similarly, a charcoal stove might be fashioned from a five-gallon oil can. Even a canned-heat burner will serve as an outdoor cook stove, in the lack of any thing else.

If your fireplace is of rigid construction, you'll have to put it on a footing that runs down below the frost line to keep it from heaving and cracking in the winter. If made of loose blocks or stones, it needs no foundation.

Smoke Needn't Be a Nuisance

In spotting the fireplace in your back yard, figure out the line the smoke will take with the prevailing *fair-weather* wind. Smoke in your eyes is a preventable annoyance, and a smoke column carried into your neighbor's open windows will win you no friends.

If you plan to burn wood, don't build the fireplace under trees; branches even a dozen feet above the fire will ultimately scorch and die. Also, downdrafts from trees—or nearby buildings—often will cause smokiness. Use of charcoal eliminates the smoke and scorching problems; its disadvantage, as compared with wood, is visual: you can't gaze with pleasant melancholy into the dying embers of a charcoal burner.

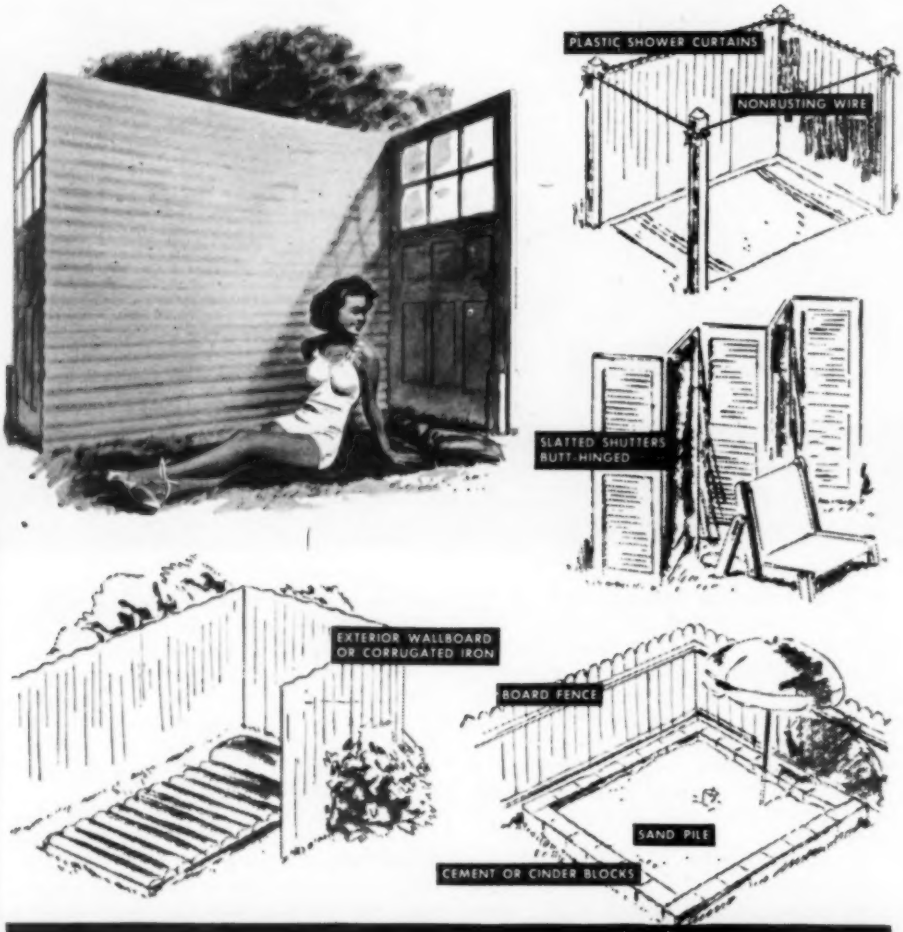
The next item in the resort pattern is that it must be a place where you can do things and have fun. We'll assume that you haven't room in your back yard for a polo field or tennis courts. It can still be a resort, if some kind of sport is available.

Table tennis is one answer. You can play that even in a small yard. A regulation **table-tennis table is 9 by 5** feet, but it can be—often is—smaller, just so it's kept in proportion. All that's needed is a strong wooden table with a smooth top painted green and marked with white court lines. It can be constructed right in the back yard and, with waterproof plywood for the top, be left there all summer in any weather.

For Eating and Sunning

What is more, you then have not only an answer to the desire for sport and exercise—and, believe me, table tennis can be vigorous—but a table around which to gather for the food from that outdoor stove. Father can invite his friends around it for a game of cards or a cool drink in the fresh air. And if Mother (or anybody else) wants to stretch out in the sun and get a tan, without lying on the bare ground, there it is, as smooth as the beach itself.

If you have enough space, a larger plat-



SCREENS

These are some of many ways to shield areas from wind and outside view. Even a small screen provides a visual shadow big enough for sun bathing if you keep low and close to it. Larger fences can be made of flexible plastic molded on chicken wire.

form will serve for paddle tennis and deck tennis—and provide even more room for sun bathers.

The bigger platform, raised a foot or so from the ground, can also double as a picnic spot. It will accommodate a flock of sitters, and give them plenty of room to set things down beside them. And if some of the younger generation want to bring out the phonograph and dance, there is their open-air dance floor.

For the small fry, swings, seesaws, and sand boxes are obvious attractions; but the resort is not complete and according to pattern until there is some water for them to paddle in. That is easily provided. I know a man who salvaged an old bath tub, dug a hole to sink it in the ground, set some rocks underneath to let the water run off when the plug was pulled, filled it with water from a hose—and never had to worry about entertaining his youngsters for the rest of the summer. They never tired of sliding in, splashing around, and climbing out to do it all over again.

That is only one way. If you don't know

where to lay hands on an old bathtub—and they are scarce these days—a piece of canvas lining a hole in the ground will do. Or, as suggested in a recent issue of POPULAR SCIENCE (July, '47), a surplus warplane wing tank, which can be picked up for about $5, can be made into an excellent wading pool. Even simpler is buying a one-man life raft, inflating it, and filling it with water. A similar pool can be made by cementing an inflated inner tube to rubber sheeting.

From such a splash pool as a minimum, one might go as much higher in the scale as ambition, skill, and finances may dictate. You can build anything from a shallow wading pool to a full-fledged swimming pool of concrete reinforced with chicken wire.

A sand pile may adjoin the wading pool as a beach or, depending on the shape and layout of your yard, be located near by. Even if your kids sunburn easily, it's wise not to put it in the shade of trees: it will stay soggy too long after a rain, and fallen leaves or needles will soon dirty the sand. Better put it in the sun, and shade the youngsters when necesary with a beach umbrella or awning.

An outdoor shower is still another way to fulfill the water requirement of the resort pattern—and one which many oldsters as well as the youngsters would appreciate. So long as there is a water connection in the yard, this is no problem, You can, of course, install as elaborate an outdoor shower as you like, but a simple tripod to hold the hose nozzle up in the air and send a spray of water down on you will do. So, indeed, will a bucket with holes in the bottom.

There you have the pattern, in its simplest form. Variations and elaborations of it, to fit individual preferences and circumstances, are left to your own imagination and ingenuity. You will probably want various items of outdoor furniture. You may want to string lights into the yard, so you can use it evenings. If so, you will surely want to include one of the bug lights now available to lure the insects into annihilating themselves.

Just take a good look at that back yard. Paste in your hat those four points of the pattern—fence, cooking unit, platform, water—and consider how they can best be combined to meet your own family requirements. You *can* have a resort in your back yard. And you will wonder why you never did before. END

Combination screen and shelter, for storage of chairs, beach pads, and tools, is formed by shed with garage doors that swing out to wings made of corrugated iron or exterior wallboard.

New Floating Bearing Will Last Lifetime

A ROTATING aluminum disk suspended in mid-air by powerful permanent magnets forms the key part of a new, radically improved GE electric meter. Virtually frictionless, this "magnetic suspension" replaces jewel bearings whose wear formerly required periodical servicing. The result is a lifetime of accurate readings with minimum maintenance.

In the new meter, the aluminum disk is the rotor of a rudimentary electric motor, which turns the indicators at a rate proportional to the quantity of power being used by the consumer. The rotor shaft of the new "Type 1-50" meter (left, above) ends in a tiny cylinder of new machineable magnetic alloy of copper, nickel, and cobalt. This fits within a thimble-shaped fitting of the same alloy attached to the meter frame. Both pieces are highly magnetized, and the interaction of their magnetic fields supports the entire weight of the rotor, as shown above at right. Stainless steel and pure carbon, in a guide that prevents sidesway, all but eliminate friction at the only contact between rotor and frame.

The "magnetic suspension" type of bearing is expected to find wide usefulness. As this issue went to press, announcement was made of its application by Prof. J. W. Beams, University of Virginia physicist, in an ultra-high-speed rotor that spins in a vacuum at 633,000 revolutions a second. This device may be used in the mechanism of rockets and guided missiles, as well as for high-speed laboratory centrifuges.

Photos Print on Cloth

PHOTOGRAPHS can now be transferred directly to fabrics, revolutionizing the ancient art of cloth printing. The technicians at right are attaching transparencies to the glass rollers of the new "press." Mercury-vapor lamps inside the rollers transmit the image to cloth, dipped in light-sensitive dyes, which then passes through developing and fixing baths. The Photone ® process is said to produce softer tones than older methods.

Magnetic Oil Holds New Clutch Tight

This new clutch developed to feed an electronic computer may take the jerks out of driving an automobile.

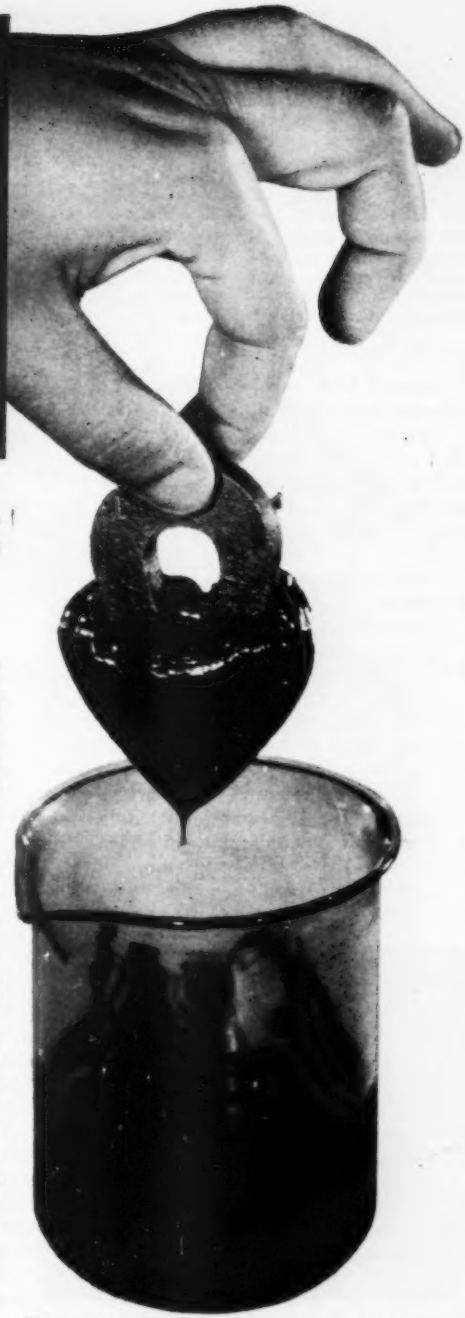
By John F. Loosbrock

THE problem Jacob Rabinow faced was how to satisfy the appetite of a giant electronic computer that gobbles facts and figures at incredibly high speeds. To solve it, he has produced a versatile device that may also take the jerk out of automobile driving and automatically push the buttons in a push-button war.

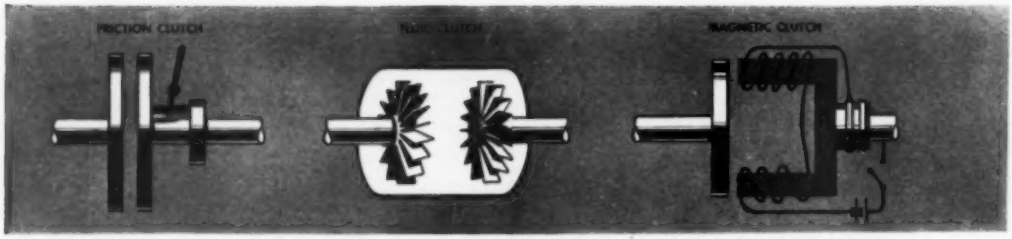
Rabinow is chief of the Ordnance Mechanics Section of the National Bureau of Standards in Washington. The Bureau currently is working on a complex electric brain, the Electronic Discrete Variable Automatic Computer. Information is fed into this device on magnetic steel tape pulled along by rollers coupled to electric motors. Since the computer can digest a million magnetic impulses a second, the tape must reach top speed as quickly as possible after the mechanism is turned on—otherwise valuable time is lost.

Rabinow's job was to design a clutch that would couple the motors to the rollers almost instantaneously, without jerking at the start or slipping at high speed.

Research led him to an electrostatic clutch invented by a man named Winslow. Winslow's clutch (shown in a diagram on page 85) utilized tiny particles of ordinary starch suspended in oil between two metal surfaces. It was a good clutch, but



When this small permanent magnet is immersed in a mixture of powdered iron and oil, the "gunk" solidifies and adheres to the magnet. This principle led to the magnetic fluid clutch.

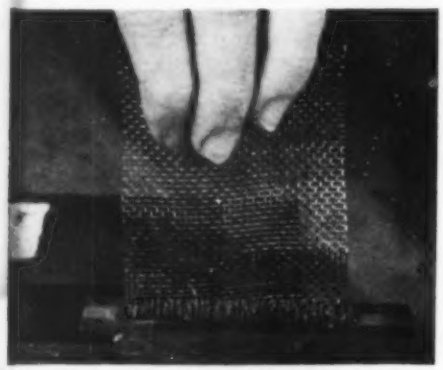


Dry friction clutch uses plates of unlike materials pressing against each other. It wears rapidly, overheats, and lacks uniformity. Fluid coupling combines centrifugal pump with turbine for smooth action, but cannot be locked, hence wastes power. Dry electromagnetic type is fast, easy to control, but tends to overheat and isn't smooth. Winslow electrostatic clutch (far right) is good for fast control but needs high voltages and close spacing of its plates.

it required high voltages and close spacing —factors Rabinow wanted to avoid.

"What would happen," thought Rabinow, "if I substituted electromagnetism for electrostatic attraction and iron particles for the starch?" He stirred up a "gunk"—his own term—of oil and iron powder. Into it he dropped a small electric motor, with a steel cylinder substituted for the rotor. When he turned on the juice, the gunk gummed up and froze the cylinder so solidly between the poles of the motor that he couldn't turn it with his fingers.

Rabinow hadn't expected quite so much. He was afraid the iron particles had got into the bearings and jammed the motor. But further tests proved his original hypothesis. The gunk became solid when magnetized, and the degree of solidification could be controlled precisely and quickly (1/30th of a second or faster) by regulating the strength of the magnetic field. The magnetic fluid clutch was the next step to come.



Screening, dipped into magnetized iron-oil mixture, shows how metallic particles align themselves into "chains" that bind the clutch plates as tightly as would steel clamps.

In its simplest form the new clutch consists of a driving shaft with a magnetic plate at its end, and a driven shaft also tipped with a magnetic plate. The iron-oil gunk fills the space between the plates. It is the only connection between the driving and driven elements.

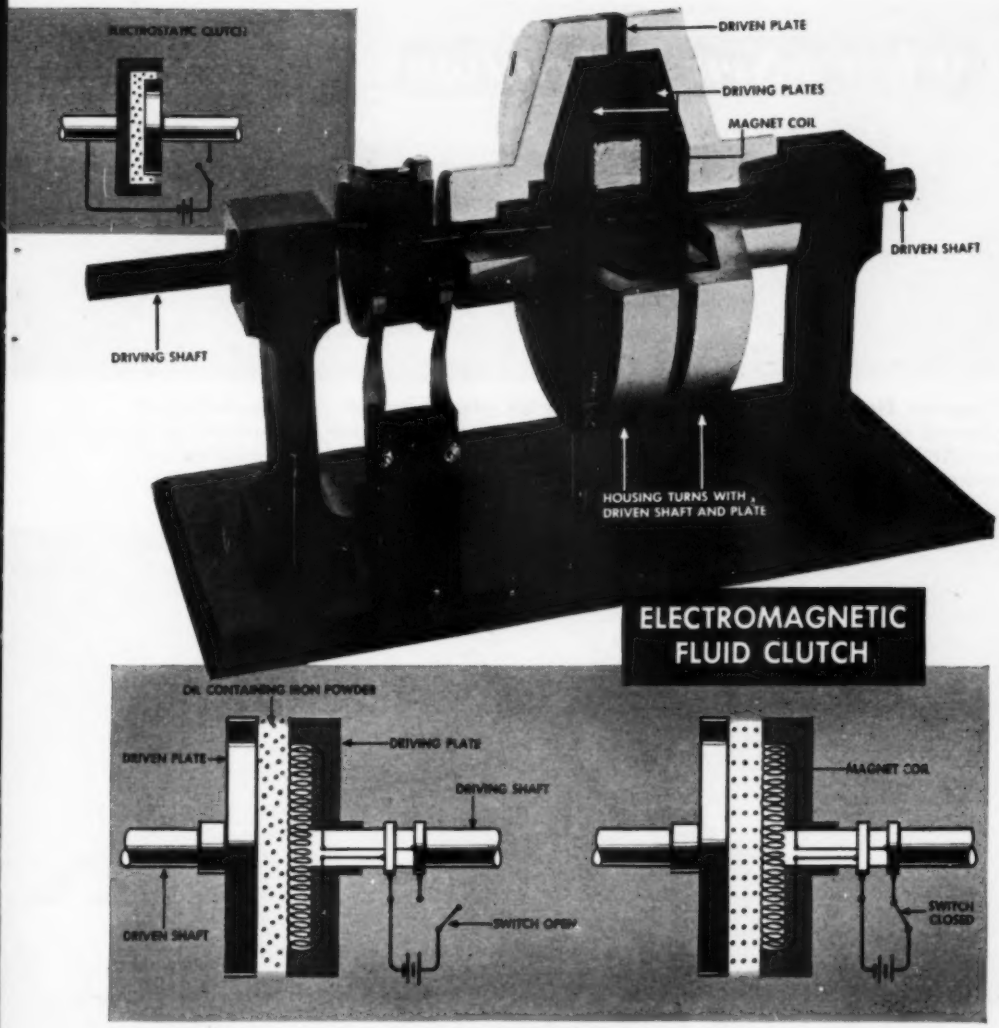
A magnetic field established between the two plates snaps the iron particles together into "chains" that lock the plates. When the mixture is demagnetized, it returns to its original fluid state and the driving plate turns freely. Since an electric current produces the magnetic field, the binding power of the mix can easily be regulated by increasing or decreasing the current.

Many Advantages

Preliminary tests indicate many advantages over other clutches. Since all surfaces are bathed in oil, action is smooth and wear almost nonexistent. Any abrasion merely adds to the supply of iron particles and may actually increase efficiency. The clutch is easy to control and requires only a small amount of electric power. The type of oil used is unimportant, so silicone liquids may be used for good performance at very low and very high temperatures.

Most obvious application of the clutch, of course, would be in autos, although such a model has not yet been tested. Its characteristics of easy control and low voltages are made to order for automatic transmission systems, where permanently engaged gear trains are clutched in and out according to speed, throttle setting, power load, and so on. Its long life and simple construction also recommend it for autos.

But Rabinow and his associates believe the biggest field for the new clutch is in



Cutaway model of a simple magnetic fluid clutch. Varying the strength of the magnetic field controls the "stickiness" of the iron-oil mixture that fills the clutch casing. Any degree of torque from complete disengagement to complete locking can be transmitted from driving shaft to driven shaft smoothly and almost instantaneously. Diagrams show how it works.

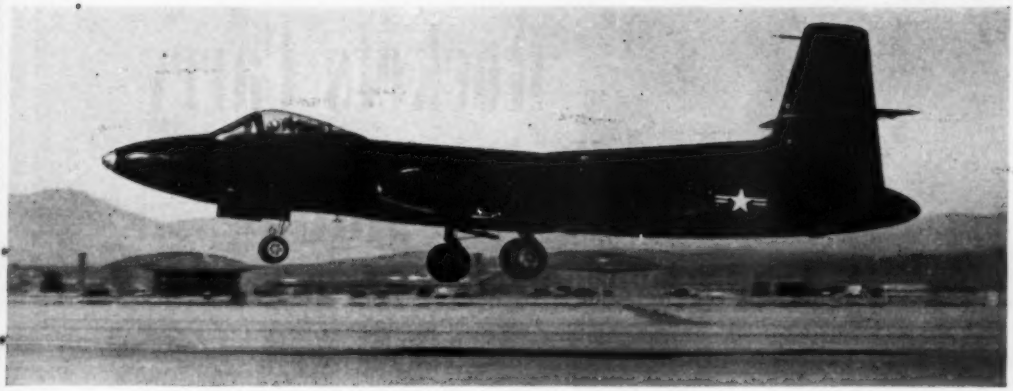
servo mechanisms—those little electric motors that translate electronic information into reactions of purely mechanical instruments—that do the pushing for the push-buttons.

Even now, servos are steering large trucks, tanks, and aircraft. They operate power brakes in trucks and in some custom autos. They control printing presses and radar antennas, sight and fire big guns, and run electronic calculators.

Servos can be operated with variable speed motors, hydraulic transmissions, and other means, but clutch-and-brake systems work the best. Since servos must operate smoothly over a wide range of speeds, they must be easily and almost instantaneously controlled and must resist wear. Here is where the magnetic fluid clutch, which fulfills all these conditions, will probably find its greatest use. END

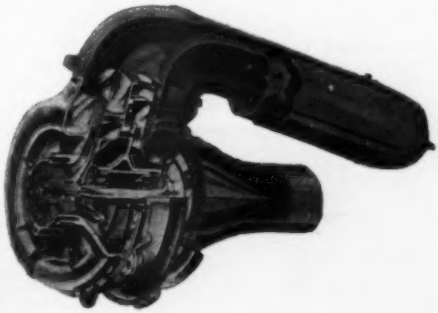
'Copter Designed for Sea Duty. All-metal rotor blades are featured on this new XHJS-1 Sikorsky helicopter. It is intended for utility, rescue, and observation work aboard aircraft carriers, battleships, and cruisers, so the tail rotor is raised above head level for safety in shipboard landings. A floor hatch permits aerial photography.

Shooting Star Doubles Up. To speed up training of USAF jet pilots, Lockheed has developed this two-seat version of the P-80. Called the TF-80C, it is powered by a new Allison engine, and is identical with the Shooting Star except that it is 38 inches longer and has a seven-foot, hydraulically operated canopy enclosing both pilots.

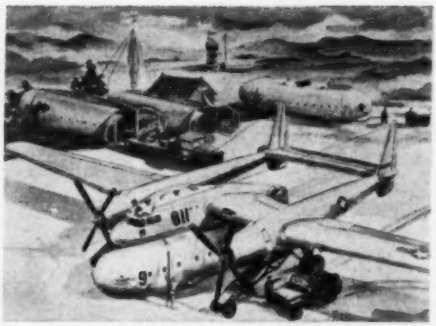


Four-Jet Take-Off. Almost as big as a B-17 Flying Fortress bomber, this huge Curtiss-Wright XP-87 jet fighter recently made its first successful test flights for the U. S. Air Force. Built for operation under all kinds of weather conditions, the plane is powered by four Westinghouse 24C jet engines. It carries a crew of two.

Target Planes Get Jet. War-surplus turbosuperchargers, with a combustion chamber added (right), make cheap, expendable jet engines that provide high-speed propulsion for the Navy's target drones. The tiny power plant, weighing only 181 lb., is made by West Engineering, of Los Angeles.



Jet Escorts Jet. With a speed of more than 650 m.p.h., the sweptback P-86 jet fighter, in foreground, makes an ideal medium-range escort for its big-bomber brother, the four-jet B-45, in background. It can accompany the 480-m.p.h. bomber 500 miles from its base. Both are North American planes, with TG-180 turbojet engines.



Sky Trailers Are Coming. A detachable-fuselage plane, to be known as the C-120, is being developed by Fairchild for the Air Force. Artist's conception shows how the cargo compartment, with a nine-ton capacity, would fasten to the carrier plane. It may prove possible to drop the pack in flight, or skid it off at low altitude.

Mail-toting rocket is a stainless-steel tube 11 feet 3 inches long. Unloaded, it weighs only 60 pounds. Cost: $50. Letters are carried inside four tail fins that stabilize it in flight.

Rockets Carry The Mail

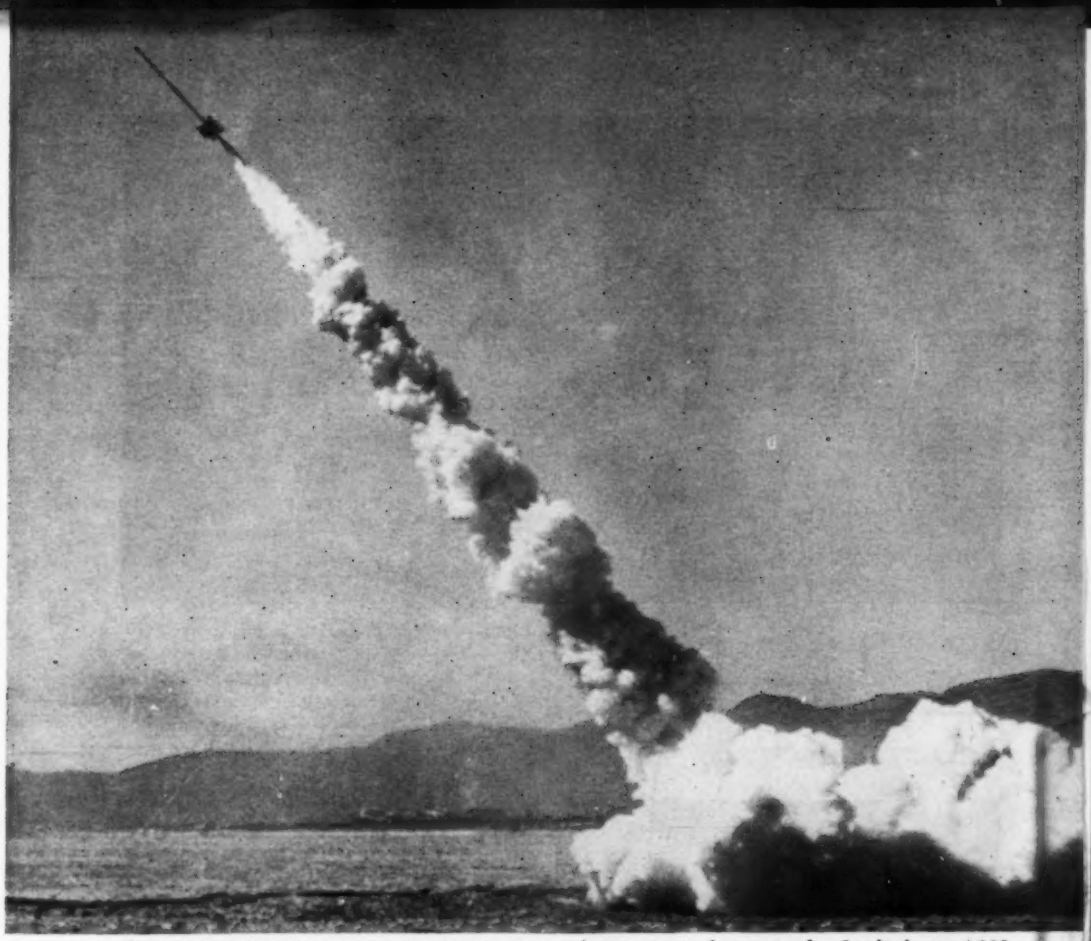
WATER barriers and impassable terrain may be no more able to halt the mails than the traditional snow, rain, heat, or gloom of night, if these experiments work out. Rocket postmen can hurdle obstacles in a few seconds, as shown in these pictures. Here the fiery missiles are carrying letters a mile and a half across Searles Dry Lake in southern California.

The demonstrators are amateur rocketeers of the Glendale, Calif., Reaction Research Society, whose 90 members are mostly high-school and college students. Their work carries forward experiments broken off in Austria, Germany, and England when rockets were drafted for war.

The equipment seen in action here could speed the delivery of letters to off-shore islands surrounded by heavy surf or to villages in mountainous territory where a mile or two might be a day's walk. It could also be adapted for use on mail steamers that must travel for hours along a coast before making port.

Launching tower, below, is 14 feet tall. The rocket slides along an aluminum T-stock on three ball-bearing clips. Operator in foreground is connecting ignition wires to fuse.

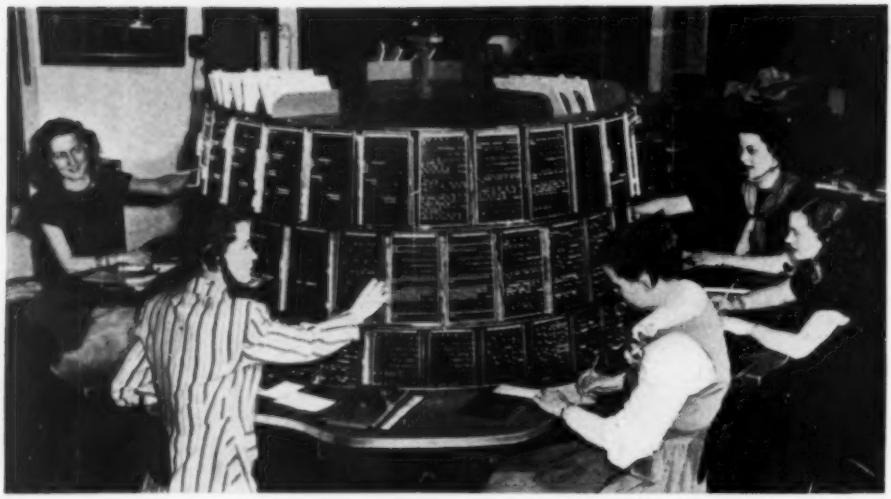
In foxhole a safe 250 feet from the launcher, rocketeer below closes contact to fuse squid, now packed in rocket's tail behind propelling fuel. Car battery supplies the firing charge.



Rocket is driven by 35 pounds of micrograin powder, mostly zinc dust and sulphur, which burns out in four seconds. It climbs to 4,000 feet and reaches speed of more than 400 m.p.h.

At its destination spent rocket is dug from salty earth in which it buried itself on landing. Tail is then removed for easier handling, and a brace is used to take covers off fins.

Opened fin shows compartments where letters are carried. Each of the four sections of the rocket's tail has room for 300. Fins are made of aluminum sheets on frame of ½-inch plywood.

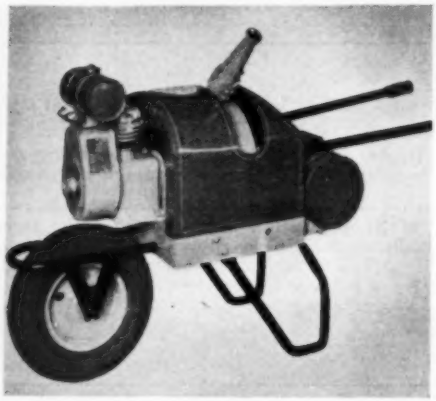


Train Space at a Glance

You'll get your train reservation in a hurry if this rotary recorder proves as good as the New York Central anticipates. Each of 84 panels on three revolving drums represents a single train for a particular day. Different colored pegs indicate the types of space still open for reservation. Now in operation at the railroad's Grand Central Terminal in New York City, the system, if successful, will be extended to other cities.

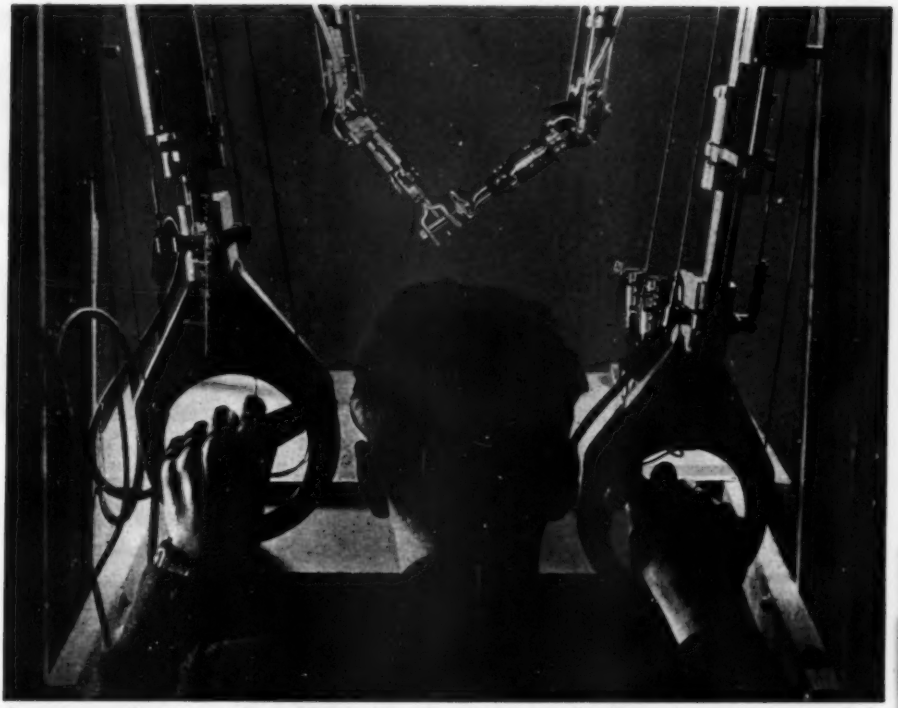
Lamps Signal Danger

These new, portable marker lights blink 120 times a minute to call attention to danger spots, road obstructions, or other temporary hazards. The big, cone-shaped one at right, designed for airport use, weighs 34 lb., the smaller one at left 22 lb. Westinghouse products, both are battery operated, with a life of 150 hours. A red neon lamp is used as a danger signal. For other needs, two-watt white, gold, green, or blue fluorescent-type lamps are available.



Mist Kills Pests

This Whirlwind Ⓣ wheelbarrow-type mist blower is a new weapon against shade-tree insects, weeds, mosquitos, and other common pests. All controls are built into the handles so that the operator can direct the spray as he moves along. Designed for small acreages by the Fitzhenry-Guptill Co., of Cambridge, Mass., the machine can send a mist-laden air stream 30 to 40 feet up in still air, or can drift the mist more than 500 feet with the wind.



Operator yards away guides mechanical hands, without usual mirrors, in putting nut on bolt.

Seven-League Hands For Hot Atoms

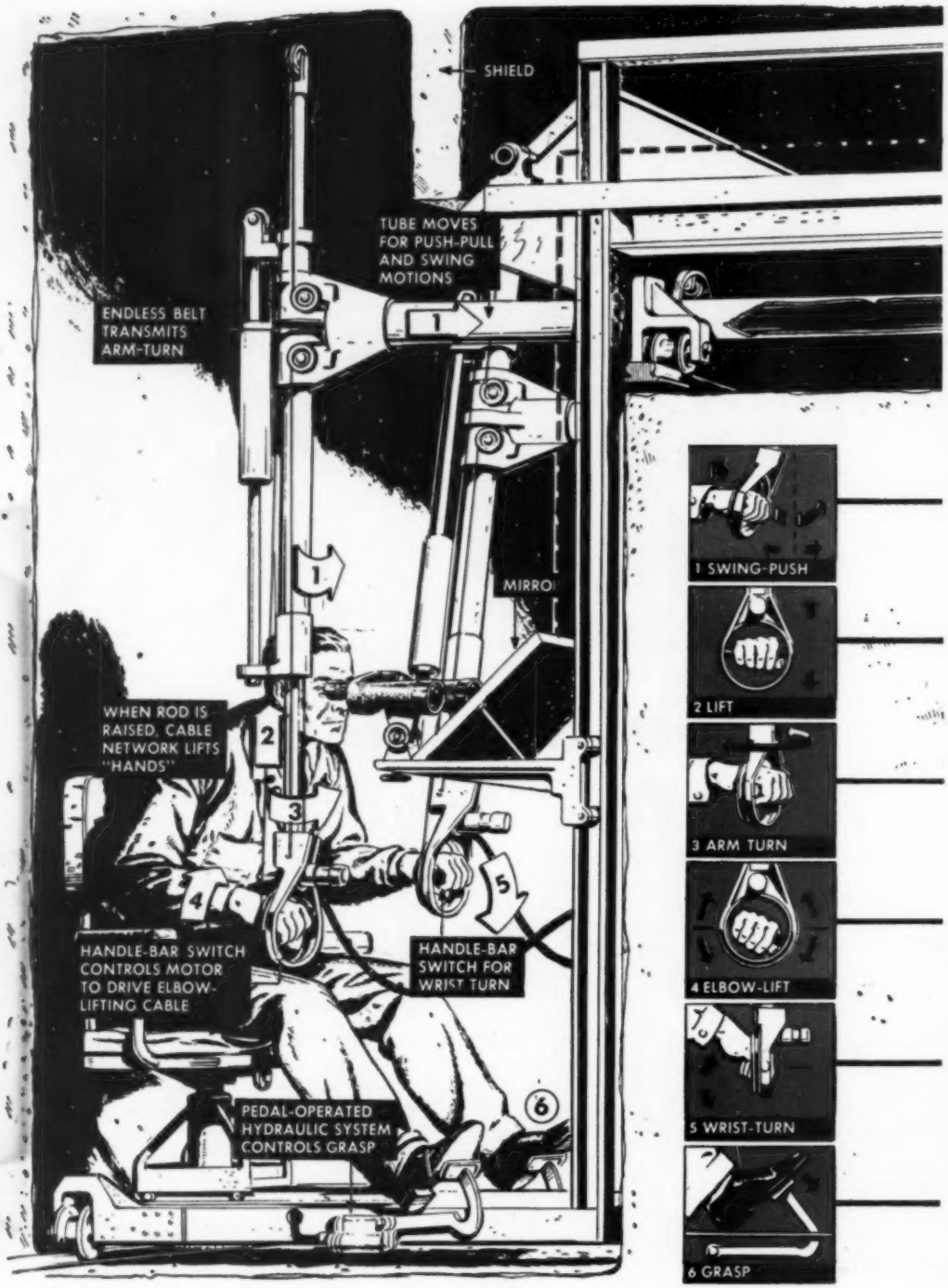
PS Photos by Hubert Luckett

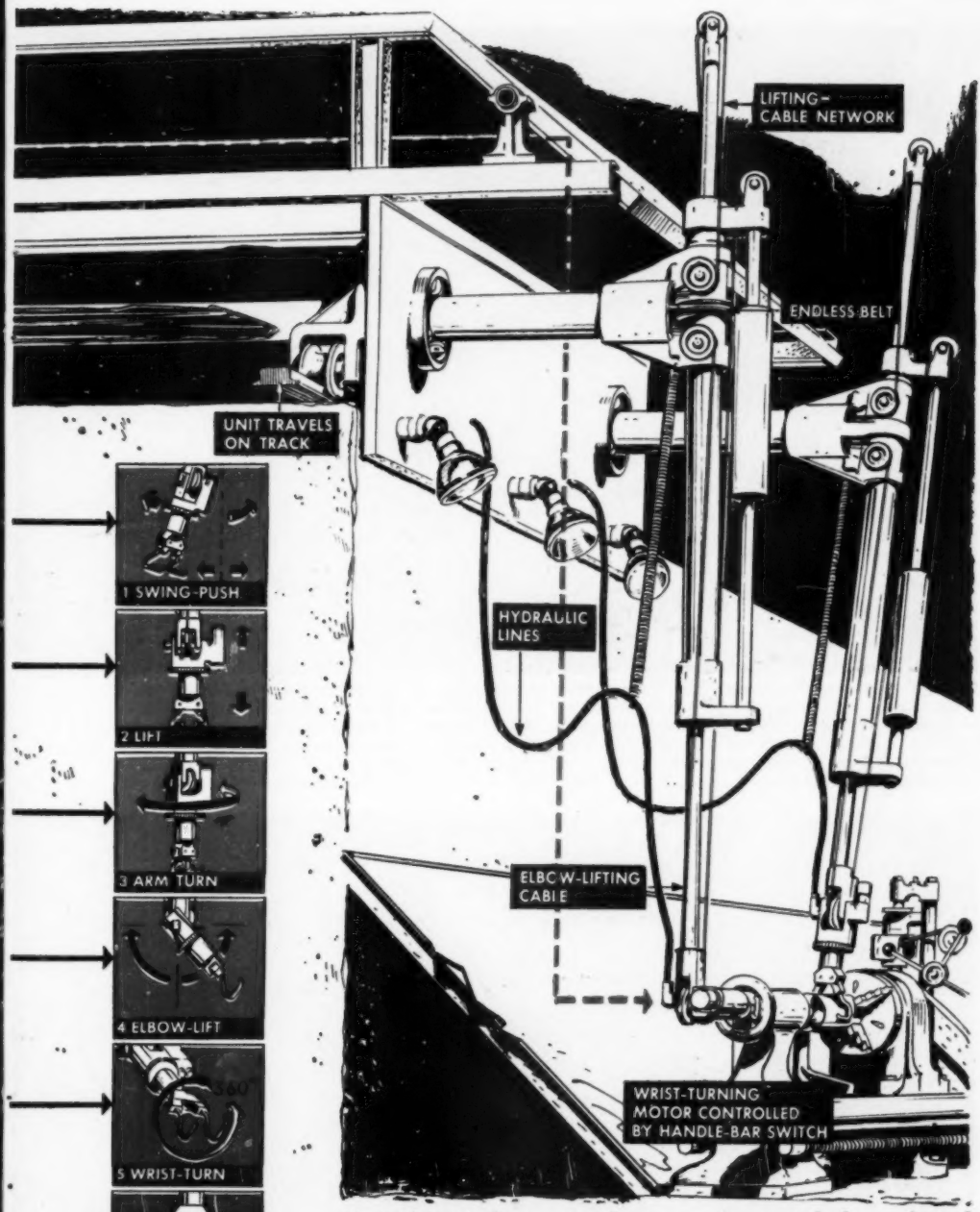
REMEMBER the sailor in the picture "The Best Years of Our Lives"—the boy who had lost his own arms but could do almost anything you can do with his "hooks"? That sailor's hooks are now a vital tool in atomic research. As the "hands" at the ends of long steel arms in General Electric's new remote manipulator, they reach over a high, thick wall to hold deadly radioactive "hot stuff"—picking it up, performing experiments with it, and operating tools on it —all at the command of a human operator sitting yards away safely behind the wall.

It all began last year when John Payne, GE research associate, toured the plutonium works at Hanford, Wash. He was impressed by the remotely controlled devices that handled intensely radioactive materials from behind shields. But he felt something was missing: there were many special-purpose devices, but no versatile gadget that could do all the jobs a man does with his hands. That night Payne went to a movie—you guessed it, "The Best Years of Our Lives." Back in Schenectady he started figuring. The result is a gigantic yet simply operated machine that *can* do the things human hands do. It runs machine tools, pours chemicals, fastens screws and bolts, even peels bananas. In every atomic laboratory from Berkeley to Brookhaven it is known as The Machine that Can Undress a Babe without Pinching.

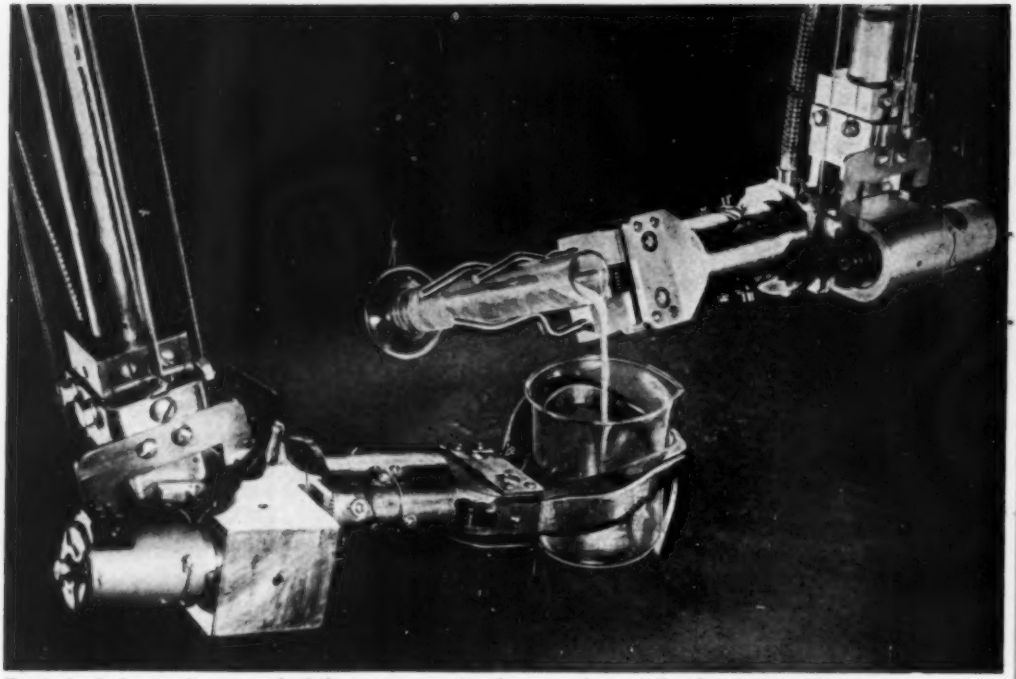
Sketch Shows Hands in Use

For artist's conception of remote manipulator setting up dangerously radioactive material in lathe inside hot laboratory, turn to next page.

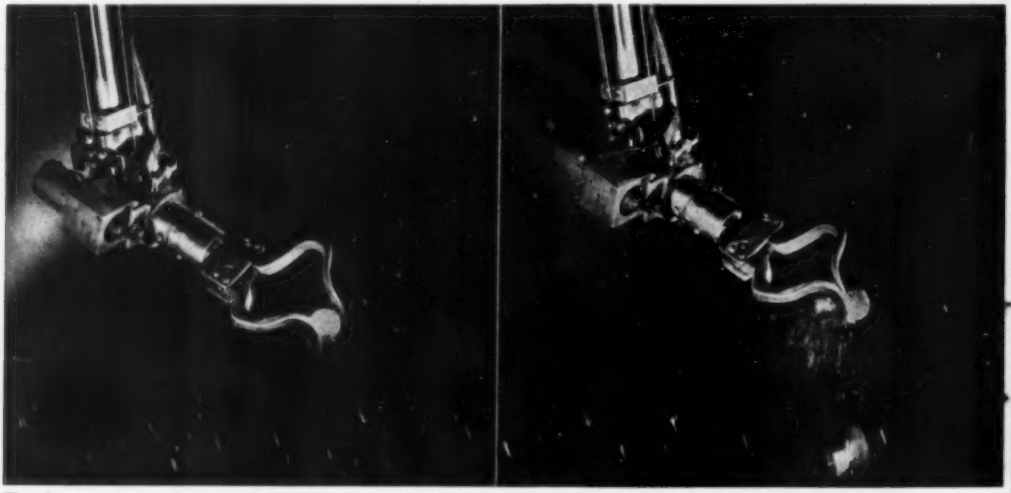

SHIELD
TUBE MOVES FOR PUSH-PULL AND SWING MOTIONS
ENDLESS BELT TRANSMITS ARM-TURN
MIRRO
WHEN ROD IS RAISED, CABLE NETWORK LIFTS "HANDS"
HANDLE-BAR SWITCH CONTROLS MOTOR TO DRIVE ELBOW-LIFTING CABLE
HANDLE-BAR SWITCH FOR WRIST TURN
PEDAL-OPERATED HYDRAULIC SYSTEM CONTROLS GRASP
1
2
3
4
5
6
1 SWING-PUSH
2 LIFT
3 ARM TURN
4 ELBOW-LIFT
5 WRIST-TURN
6 GRASP



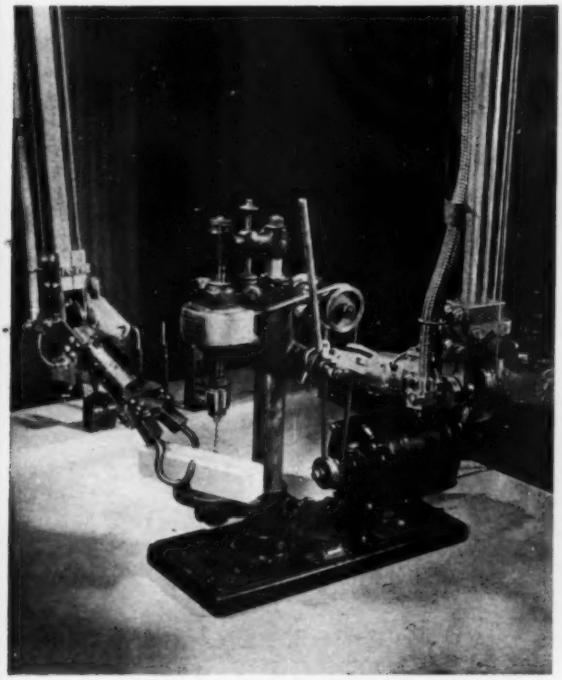
Manipulator imitates seven human motions, mostly by mechanical links. This keeps the machine simple and foolproof. Sideways swing and push-pull (1) use direct, rigid connections, while lift (2) and arm turn (3) employ cables. A cable also transmits elbow-lifting motion (4), but it is driven by motor to prevent tiring the operator. Wrist turn (5) is completely electrical, permitting continuous rotation. Grasp (6) is hydraulic and uses standard automobile brake parts.



Typical of the work expected of the manipulator is this operation with chemicals. After the correct amount of liquid has been poured into the beaker, the hands can pour from beaker into a filter, remove any precipitate left on the filter, weigh it—and throw it into a trash can. Until now, only specialized equipment for performing some of these operations was available. Such handling of radioisotopes—some so "hot" that holding a hand over the beaker for a few seconds would cause injury or death—is increasing in research with nuclear-fission products.

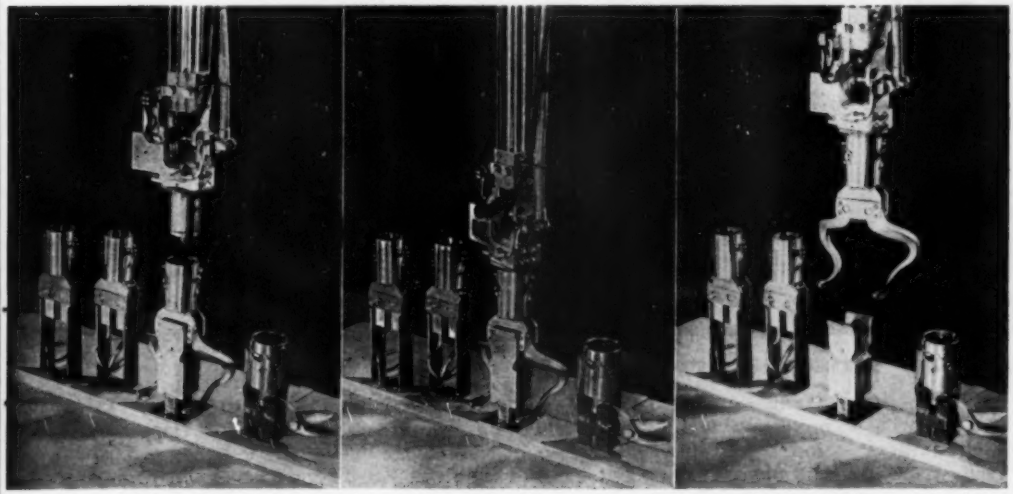


To demonstrate the operator's precise control over the machine, inventor John Payne made the hands pick up photographer's flash bulb so gently it didn't crack (left). He then pressed foot pedal a little harder and crushed the bulb (right). Foot operation of grasp was chosen because operators can judge foot pressure from experience with car brake and accelerator pedals.

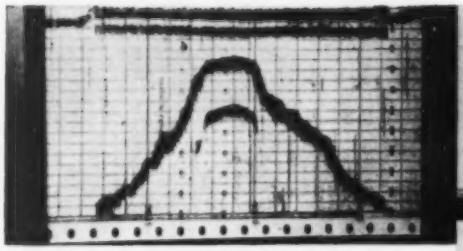


Mechanical hands can operate tools easily to drill, machine, or mill radioactive material in the form of metal bars or other solids. In fact, they can do this even better than human hands; for the mechanical wrists, unlike man's, can turn completely around and around.

GE engineer Charles Hoffman, who assisted Payne in designing the manipulator, shows how the operator works the controls. Since mirror system makes the hands seem even farther off than they really are, binoculars are used for making fine adjustments and reading scales.



Manipulator can even change its own hands, selecting them from a rack that holds several types for special jobs (note that one at right is tin snip). Left photo shows spindle positioned over socket of hand. Spindle then moves down and twists to lock hand in place (center) and finally pulls new hand from rack (right). Hands will pick up dust, become "hot" themselves.



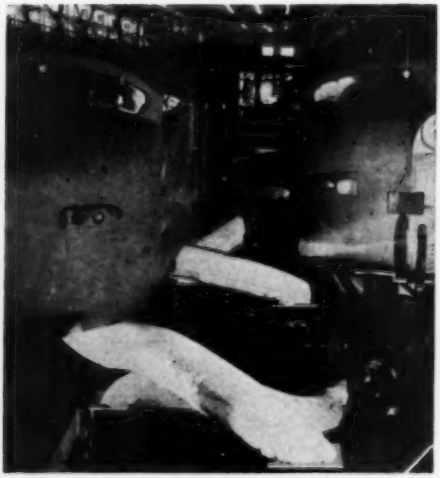
Secret Sea Peak Found

A GIANT submarine mountain more than two miles high has been found only 800 miles off Seattle. This latest discovery of sea-snooping scientists is the highest peak known in the entire North Pacific Ocean, towering up 11,500 feet to within 2,760 feet of the surface. The discovery was made by the *Pathfinder* (right), Coast and Geodetic Survey ship. Radar located the mountain and recorded its profile, shown above. The half moon just below the peak is a double echo. Sounding surveys help locate new fishing grounds and aid ships using submarine peaks as navigation guides.

Photos by the Coast and Geodetic Survey

"Boots" Protect Bridges

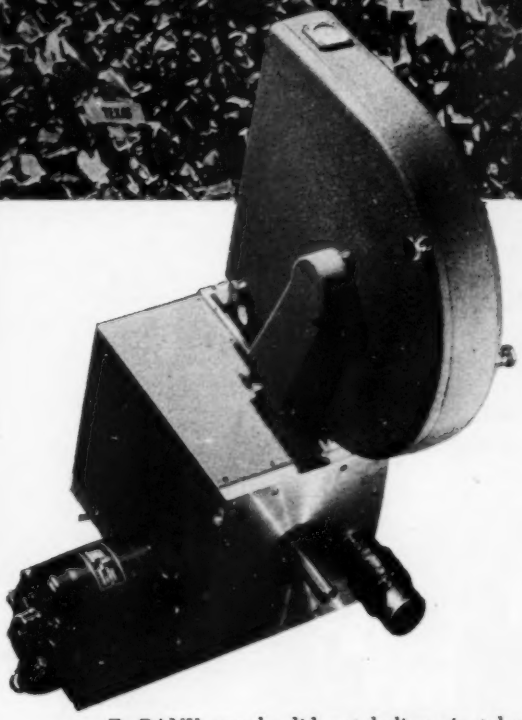
"BOOTS" of ¼-inch wrought iron filled with concrete are now protecting two Massachusetts bridges against the erosive action of salt water, ice, and tides. Top photo above shows how the concrete piles on one, the Bass River Bridge, near South Yarmouth, had been badly worn; below is the same bridge after installation of the "boots."



Locos Grow "Legs"

LOOKING as if they are about to get up and walk away, these Westinghouse electric locomotives are undergoing tests before final assembly at Pittsburgh, Pa. The crab-like "legs" are canvas tubes used to ventilate their electric motors, between the cabs awaiting installation. Six motors, totaling 4,000 hp., are used in each locomotive.

How You'll See a President Nominated



Television cameras like one above will show 1948 political conventions to audience of 3,000,000. Movie cameras, including new Kodak (left) that photographs screen image, will also be used.

MANY people did not believe in telegraphy until it was used at the Democratic National Convention in 1844. Radio was not fully appreciated until after the same party's convention in 1924. This year television is expected to show its value to 3,000,000 people by enabling them to see both the Republicans and Democrats nominate presidential candidates.

Every video station in the East will be tied to the Philadelphia convention hall. And movies will be rushed to stations beyond the present networks' reach. More than 15 television cameras, as many movie cameras, dozens of high-powered spotlights, nearly 100 microphones, and miles of wire have been assembled to do the job.

Inside the big auditorium, four television cameras will be operated cooperatively for all stations by the three tele networks. As shown on next page, two cameras will be in a balcony box, another opposite. They will give you a better look at the speakers than any delegate gets, and can be swung to cover the floor. The fourth camera, in a corner of the stage, will cover the rostrum. Beside each tele unit will be a movie camera. Films will be edited into short summaries and televised at the end of each day.

Powerful lights will flood the auditorium for both television and newsreels. Ten 10,000-watt "floor broads" will be installed in the balconies, and ten 5,000-watt "high broads" will hang from the ceiling.

Artist's conception of convention scene at the Philadelphia auditorium shows how cameras located inside and outside will get varied shots of activities. Director, sitting before battery of viewing screens in booth at right side of stage, can select picture from any one of five cameras for transmission to television stations, either over coaxial cable or by microwave relay.

Box on balcony holds two cameras to cover stage or demonstrations on floor.

Camera in corner of stage will make close-ups of speakers, like that above.

Single camera on special platform covers stage from distance for wide view.

Colorful events outside building will be picked up by crew near entrance.

Cutaway above shows location of the office-elevator in a corner of the building, enabling the manager to hold conferences with persons on various floors without leaving his desk.

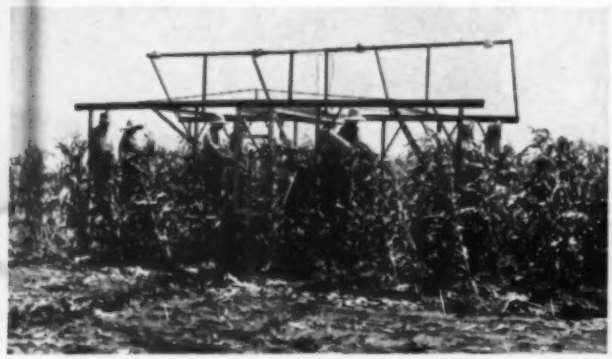
Office Goes Up and Down

BY MERELY pressing a desk button, the manager of this factory can move his office to any of the building's 14 floors. Originally built for the head of the Bata (shoe) Works in Zlin, Czechoslovakia, the office is fitted into a corner elevator of the structure. It's believed to be the first of its kind. The corner location of the mobile office affords plenty of light through big windows. Operation is reported to be so smooth that there is no feeling of motion when the unique room goes up and down.

The 24- by 24-foot office is air conditioned, soundproof, and has running water. There are internal and outside telephone connections, as well as a plant-wide broadcasting system.

Corn Bred With Care

WHEN the time comes for crossbreeding corn to produce improved strains, the job must be done in a hurry lest stray pollen from undesirable varieties gets there first. The answer is a tractor-driven machine (left, below) that carries a group of workers through the corn fields as fast as two and a half miles an hour. As it moves along, the workers pull the tassels, as shown at right, and apply pollen by hand.



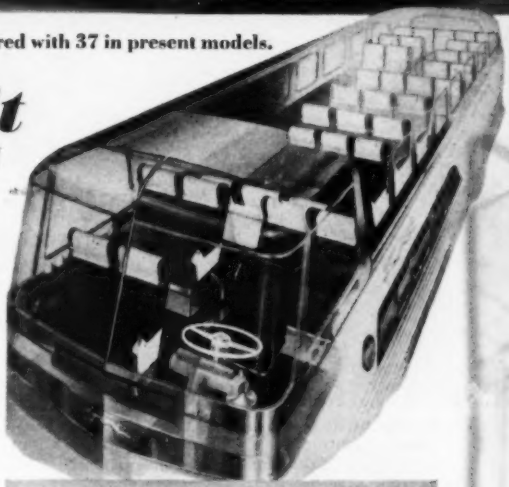
Highway Traveler Ⓣ seats 50 passengers, compared with 37 in present models.

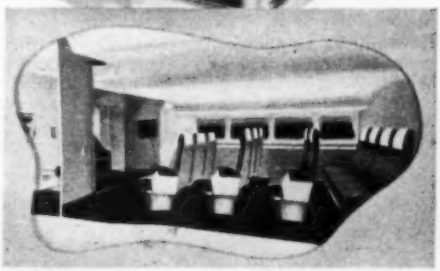
New Bus Built For Comfort

NOW purring around the country on road tests is a Greyhound bus packed with new tourist luxuries and safety "firsts."

It's the first bus with a self-sealing fuel tank, first with twin air-cooled engines, one of the first with wire-cord tires to reduce blowouts. The driver sits practically in a glass dome. Both for safety and view, most of the seats are above the traffic level.

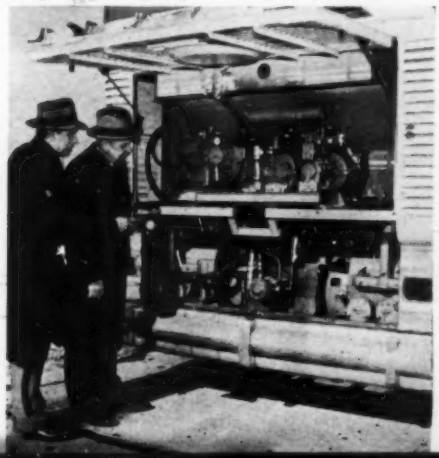
An automatic steering control prevents any sudden bump from deflecting the wheels, and a new Hydrotarder Ⓣ—a sort of fluid-friction clutch in reverse—saves brakes on downgrades.

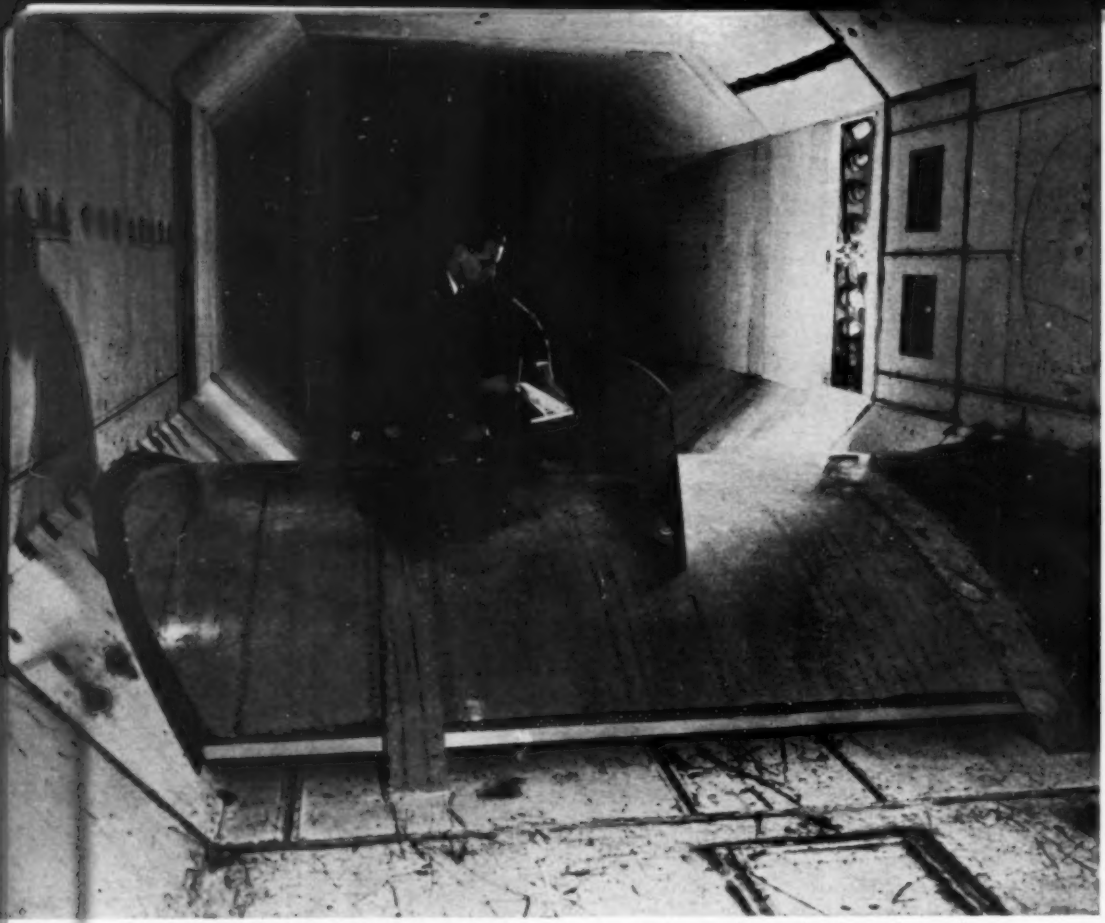




Double-deck seating provides for 6 passengers (plus driver) in Fore Lounge and 31 in Terrace Lounge, on upper level. Thirteen more are carried in Sedan Lounge underneath. Lower level has drinking fountain, refrigerated cabinet, and lavatory. Seats are wider and windows larger than those in current buses. Individually controlled pillow-type radio speakers in headrests offer choice of two stations. Body framing serves also as air ducts for cooling and heating system. Luggage is carried in lockers in side walls, acts as shock absorbers in case of crash.

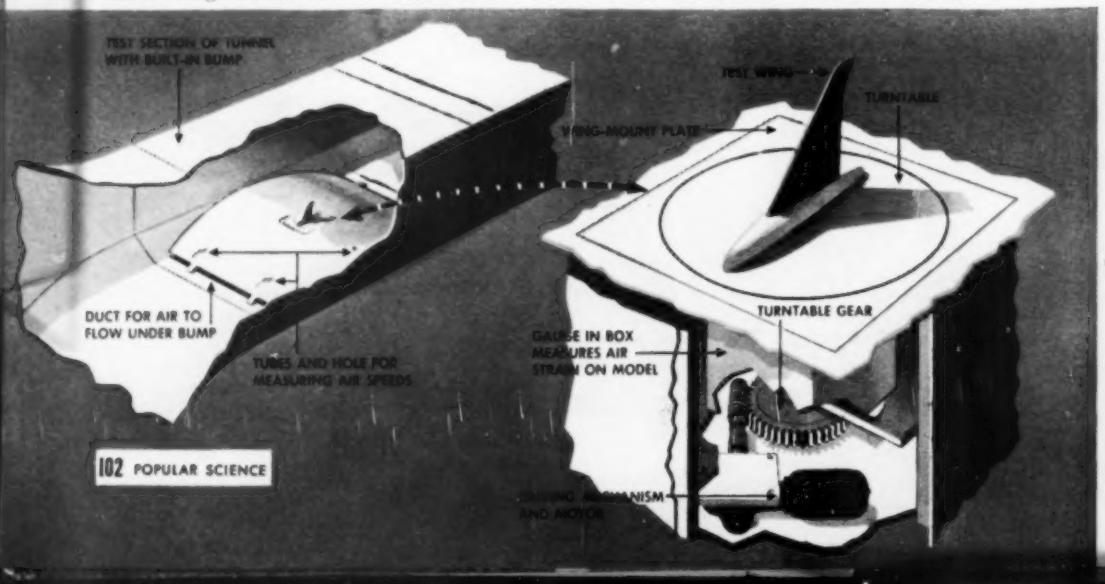
Twin engines are air cooled. One normally propels bus, other operates accessories but cuts in automatically on hard pulls. Either can keep the bus going if one breaks down.





Bump in its floor enables wind tunnel at California Institute of Technology to fill test gap between subsonic and supersonic speeds. Elusive transonic speed—exactly that of sound—is reached where air traveling slightly slower is squeezed as it passes over the bump.

How model airplane wing is placed on the bump for testing is shown in cutaway sketches below. Wing is attached to 16-inch turntable that can be rotated to change hitting angle of the wind. Bump is permanently installed on a metal cart that is rolled into the tunnel.



Planes Race Past Sound; Bump in Floor Shows How

By squeezing air in a wind tunnel, engineers help solve the problems of flight through the transonic region.

By Andrew R. Boone

FOR years pilots and engineers have worried about what would happen to an airplane that entered the terrifying region bounded by the speed of sound. Under that speed, an airplane was safe; above that speed, an airplane would be safe. But *at* that transonic speed the cockpit controls might "reverse," and a plane do just the opposite of what it was supposed to do. Transonic forces might even shake a plane apart.

Now they know that little need happen at the speed of sound that doesn't happen normally in flight at other speeds. In fact, the government research agency, the National Advisory Committee for Aeronautics, refers freely to "the transonic research airplanes *now flying*."

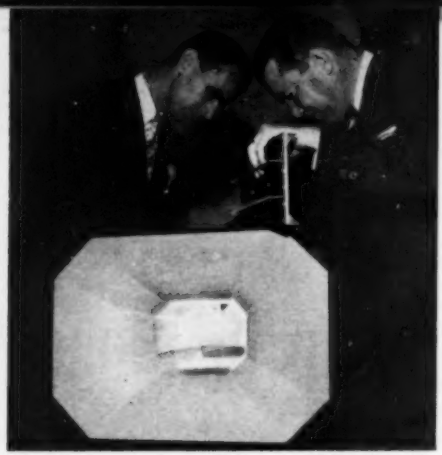
The scientists have discovered what to do to an airplane to make it fly successfully into and through the mysterious transonic region. They found out by building a bump in a wind tunnel to produce an air speed equal to that of sound, and testing the behavior of model planes and parts in this blast.

Without the bump, air blown through the tunnel flows smoothly at speeds below that of sound; but, just at that speed, it "chokes" between the walls and the test model. With the bump, air moving slightly slower than sound is squeezed up to transonic velocity for a fraction of a second just where the

Model wing is installed, below, on turntable. It has 6.8-inch span and is swept back at 60° angle. During tests, air speed over wing is measured by pressure openings on bump and in vertical plate, 10 inches high, that can be seen in photo at the top of the opposite page.

Model is polished before a high-speed test run to remove surface irregularities whose air drag would be magnified many times when readings of instruments in the wind tunnel are translated into stresses on a full-sized aircraft flown at the corresponding speed.

Model is assembled for test at transonic speed in wind tunnel with bump. Wing shown here, made of machined brass, has 5-inch span and 28-degree sweepback. Maple fuselage, shaped like that of P-80 Shooting Star jet fighter, is reinforced by aluminum strip along its base.



Miniature wind tunnel, patterned accurately to one-hundredth of an inch on the big one at Caltech, served as a working model in which these Lockheed engineers perfected bump that produces transonic air speeds. Experimental bump, of brass, is visible inside its mouth.

tunnel narrows—and where the test model is placed. Beyond the bump, the air slows up again before it has had time to choke the tunnel.

One miniature model, made wholly of metal, began disintegrating at the speed of sound—763 m.p.h. at sea level. But this was a planned disaster. By shattering its wing, Lockheed Aircraft's scientists, working at California Tech's Cooperative Wind Tunnel in Pasadena, proved that this particular design could never endure supersonic flight.

Other designs can and will. This too has now been proved. The logical design for the airplane assaulting the transonic barrier is as smooth as a torpedo.

Air 'Boils' at Speed of Sound

"In the past we have had trouble in the speed-of-sound region because air gets flustered at that velocity," says Hall Hibbard, Lockheed's chief engineer. "It acts like boiling water. But air is stable both below and above that speed.

"We have had trouble because air flows at different velocities over different parts of an airplane. A plane may be flying at 600 m.p.h., but the air must flow 763 m.p.h. or faster to get over some projection—like the cockpit cover. It's the parts of a plane, not the entire structure, that run into trouble."

So the trick is to design a plane that will disturb the temperamental air as little as possible. It will take extra-clean fuselages to pierce the transonic wall. It is also reasonable to expect, on the basis of these experiments, that these airplanes will need swept-back wings. Here's why this is so:

On the conventional Lockheed Shooting Star jet fighter, air drag suddenly goes up around the wing at 625 m.p.h. Things get worse so fast that this resistance is almost eight times as great at the speed of sound as it is at 625 m.p.h. But sweep back the wing 50° and the air doesn't start to act up until 742 m.p.h., and the resistance at sound's 763 m.p.h. is only twice as great. This means that a conventional Shooting Star would require 55,000 hp. to smash through transonic resistance; one with a wing swept back 50°, only 22,400 hp.

Wings will be thinner too, the wind-tunnel tests show, but they must be rugged. Otherwise, they may twist under pressure of the aileron and thus apparently reverse the effect of the controls. When this danger is avoided by proper design, the transonic barrier is reduced to a momentary loss of control due to air turbulence. And designers hope to get around even that by altering the tail.

"Tails present the same problems as wings," explains Paul W. Theriualt, Lockheed's wind-tunnel chief. "They are actually small wings. There will be a tendency to place the tails higher and farther from the wings, to get them away from the wake and turbulent air. Tails will probably have more sweep than the wings, so that the compressibility effect will be felt first by the wing. During that critical initial period, over in a second or two, the tail will control the airplane."

Still secret is the exact wing shape that keeps control past the speed of sound. END

Handle Fits Your Hand

HERE'S a new kind of handle that's tailor-made to fit your hand. When your fingers slip into its grooves they do a better job of gripping, lifting, and carrying. Called the Wedge-Lock Ⓣ Handle, it was perfected by a New York industrial designer, Thomas Lamb, after anatomical studies.

To take advantage of the thumb's full power—overlooked in conventional handles—Lamb has made separate, wedgelike grooves for thumb and index finger, and a curved gripping surface for the other fingers. This not only makes the fingers comfortable, but also distributes the work load so that each finger does its full share.

Ideal for plastics since it can be molded, the handle can be made out of almost any material, such as glass, metal, wood, or rubber. Besides present uses shown here, experiments are being made to adapt it for hand tools, tennis rackets, and fishing rods.

Ideal for pots and pans, fitted grip allows the new handle to be used safely even when hands are wet or greasy. Used as a suitcase handle (upper right) the device prevents arm cramp.

Adapted as a welding-instrument handle, the valves controlling the oxygen and acetylene are conveniently placed directly under the operator's thumb. This use is still experimental.

This phantom photograph shows how the handle equalizes stress and strain over the entire hand. Contours utilize 100 percent of hand's power during holding, lifting, or carrying.

Made of aluminum for hunting knives, the handle cannot slip, slide, or roll in the hands. Result is less fatigue in skinning operations. Sheath is made to fit handle configurations.

Worms'-eye view shows how handle narrows at base for perfect fitting of thumb and forefinger. It not only fits all sizes of hands, but is made to be used with either the right or the left hand.

It took 10 colors, plus casein size and alumina clay (in foreground), to produce this wallpaper design. Colors in front row go on first (l. to r.), then those in the second row in same order.

A staff designer puts the finishing touches on the original design before its transfer to the printing rollers. It will be reversed several times to make pattern come out the right way.

The block-cutter, working with an arsenal of tools, hammers in strips of brass, following the outlines of the pattern. Red #5 seen on roller indicates that this one will print in fifth position.

It Pays to Know Your Wallpaper

Technical progress has made new papers that can take the punishment of sunlight, water—and even the kids.

By William P. Vogel, Jr.

PS photos by W. W. Morris

THE next time Junior smudges ink, mud, or tar over the wallpaper in your front hall, don't blow your top. That wallpaper may be a modern, washable variety. If so, you can take the surface grime off with plain soap and water. And to remove more stubborn stains, you can dry clean it—just like a suit of clothes.

Advances in paper and pigment chemistry in the last dozen years have enabled some manufacturers to produce wallpaper that they are willing to guarantee for up to three years—and that guarantee may also include the cost of hanging it.

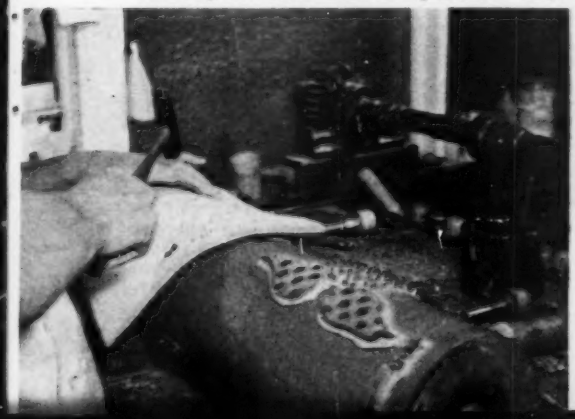
Thousands of miles of washable wallpaper, costing from 40 cents to four dollars a roll, are sold every year. By a "roll," a wallpaper man means enough paper to cover 36 square feet. The one you buy, however, is technically a "bolt," consisting of two rolls if it is 20 or 22 inches wide and three if it is 30 inches wide. Twenty-inch paper, which trims down to 18 inches on the wall, is sold in double rolls, each roll being 8 yards long. Double rolls of 22-inch paper, which trims to 20½ inches, are 14 yards long. The 30-inch paper trims to 28 inches, comes in three five-yard rolls.

Nine-tenths of the wallpaper used today is light-fast and washable. For summer bungalows, hunting shacks, and other temporary dwellings, you can buy papers that are not washable for as little as a half a penny a square foot. But for your home, the washable papers are the best bet. You can hang them in the steamiest kitchens, the dampest bathrooms, the most glaring sunporches—and even in showers if you coat the paper with a special lacquer.

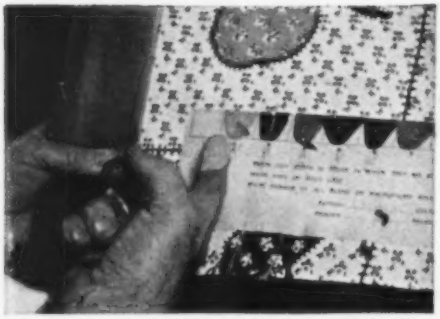
The presses that produce this wallpaper each turn out from 500 to 1,000 rolls an hour. The paper is a special stock known as "Hanging No. 2," which has just the right "feel" to absorb the color and hold it tight and to take in the paste so that the paper will hang smoothly on the wall. It is a mixture of ground wood and sulphite pulps, about four parts to one respectively. Too much sulphite makes the paper too hard.

The Imperial Paper and Color Corp., at Glens Falls, N. Y., gets most of its raw

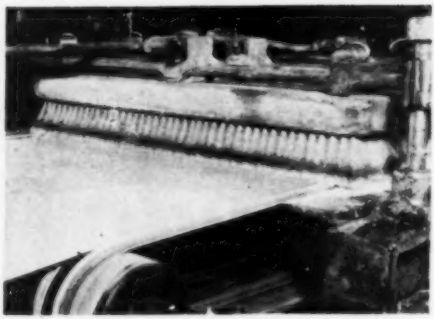
Larger spaces of solid color in between brass-strip outlines are covered with felt, which is scored, cut, and then hammered in. The felt soaks up the water color and prints it evenly.



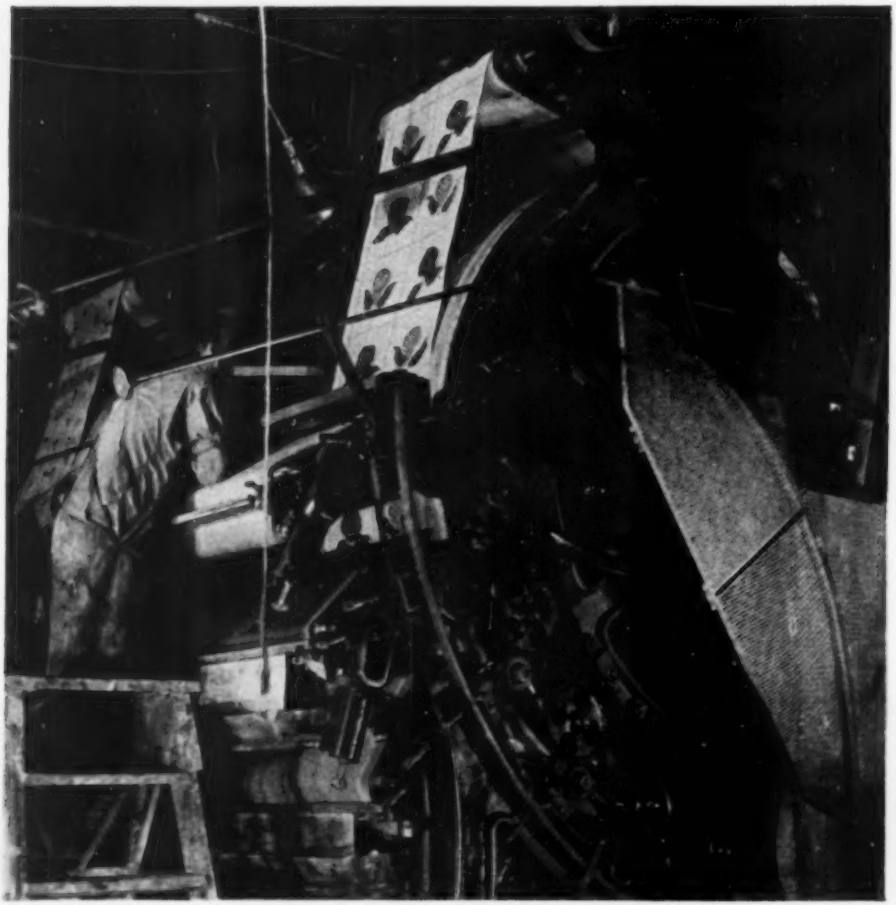
Before going to the press, rollers are smoothed on grinding lathe with pumice and water to remove any high spots that might cause uneven printing. Block of pumice is in background.



To insure exact matching, colors are checked against those of original run. Although they are darker when wet, long experience enables the mixer to tell how they will look when dry.



In first printing operation, solid background tint is brushed on with three fine-bristle brushes moving rapidly over the paper. Background coats can also be blown on under air pressure.



On the big rotary press, which can accommodate up to 12 rollers, the design colors are printed in rapid succession, the lighter tones generally preceding the darker ones. At the end of each printed reel, colors are again checked against originals for possible variations. Note that the pattern is printing on the paper upside down. Most wallpaper presses run this way.

stock from its own plant 125 miles farther north in Plattsburg. Before this paper is used, it has to jump through hoops in the test laboratory. Samples from each mile-long roll are weighed to check uniformity of texture. They are pulled apart, burst by a small rubber balloon to test tensile strength, wetted, and then dried again. These tests tell whether the paper will stretch uniformly and shrink evenly when hung.

The designs for the wallpaper have to be just right, too. Each pattern must be between 15 and 21 inches deep, so it will repeat properly, and must not have more than 12 color tints—the maximum number of rollers on a modern wallpaper press. Designs sometimes have to be changed to prevent too much overlapping of colors or a tendency to make the wall look as if it were leaning. Optical illusions make many intricate designs look quite different when hung.

Once a design is technically right, its transfer to the printing rollers begins. Skilled craftsmen, tracing the design, etch it onto a gelatin sheet, which is then inked and pressed onto paper. The inked design is then transferred from the paper to as many hard, rock-maple rollers as there are colors used. Next, "putters-on" outline in ink the areas of one color on each roller.

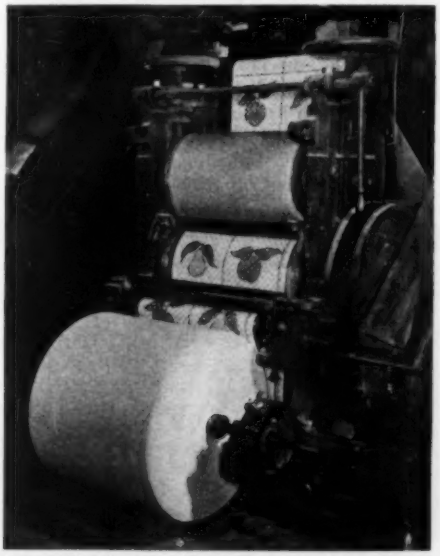
A "block-cutter" then hammers in strips of brass, following the inked outlines. Small spots of color are printed directly from these, but larger spaces are filled in with fine piano felt to hold the water color.

In Imperial's color house, as many as fifty different chemical pigments may be used to blend one tint. The finely bolted pigment is then added to a mixture of softened water and floury alumina clay from Georgia. To hold the color mixture to the paper, washable papers have a protein size, usually casein or soy-bean meal, while non-washable ones have a starch or glue bond.

Once the mixes are considered perfect, samples are blown out on a strip of raw stock, against which subsequent mixes will be checked, so that the paper you may buy five years from now will match that you buy today. Most papers are first covered with a solid tint to serve as a background and to protect the stock from light, which would darken it. After this ground coat is dried in a hot room (140° F.), the design colors are applied on the big rotary press.

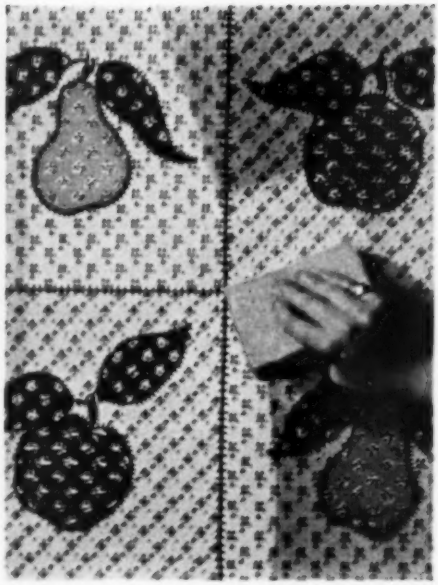
Because the colors have to be printed wet, one after another, they must not interact chemically. Chances are that a red that "bleeds" will turn dirty brown or even bleach out to white when it strikes another

Festooned over rods, the wet, freshly printed paper snakes its way slowly through the drying room, heated by air to 140° F. Later, the dried paper will get an alum bath to make it washable.



An embossing machine presses a tiny pattern into the paper, making it softer and easier to hang. This crinkles the paper and reduces its gloss, making it more adaptable for the home.

In the final stage before shipment, the huge, mile-long reels of finished paper are cut by hand into convenient "bolts"—wallpaper jargon for the rolls you get from your local dealer.

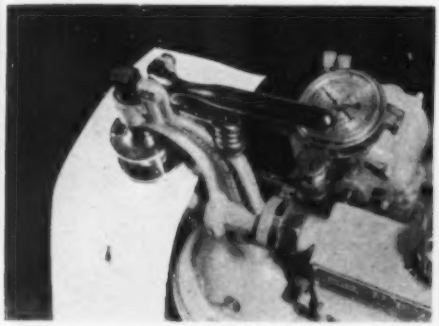


For ordinary dust or soot, a good rubbing with a dough-type cleaner will shine this paper up like new. More stubborn grime will usually succumb to any good hydro-carbon cleaning fluid.

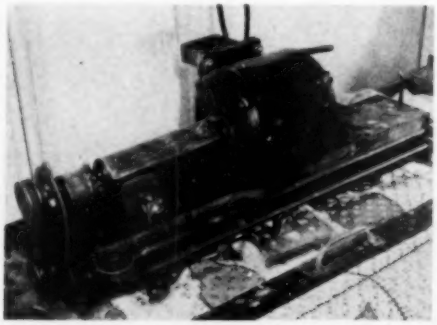
pigment. After printing, the paper is again heat-dried and the size "converted" in an alum bath to make it insoluble.

American wallpaper making has had its ups and downs. Right after the Revolutionary War, the first papers were made by hand from carved blocks, but the designs and colors were crude. After the discovery of coal-tar colors in 1860, the business took a sudden spurt, but the first colors were "fugitive"—after short exposure to the ultraviolet rays in sunlight, they faded, changed color, and sometimes vanished altogether.

Wallpaper got a bad name. Not until 20 years ago had laboratory workers learned enough to make machine-printed colors that were light-fast and papers that would not darken with age. Now, with the papers that are also washable, you don't have to repaper every time Junior goes on a crayon rampage. Just give it a bath, along with Junior, come some Saturday night. END



A **"Mullen mauler"** tests durability of raw stock before printing. A tiny balloon is inflated against taut paper strips until they burst under its pressure, indicating their tensile strength.

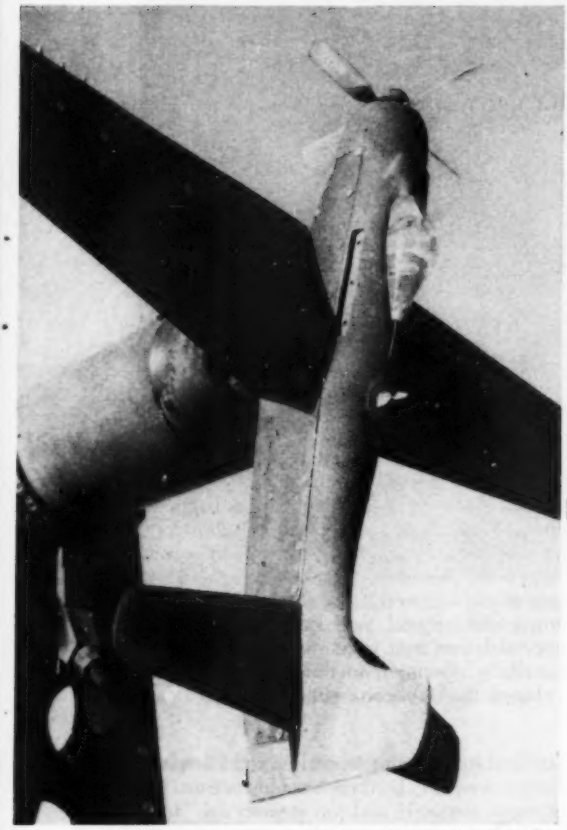


Mechanical scrubber gives samples of finished paper 200 strokes with cellulose sponge soaked in soap and water to tell how the paper will stand up under repeated washings in the home.

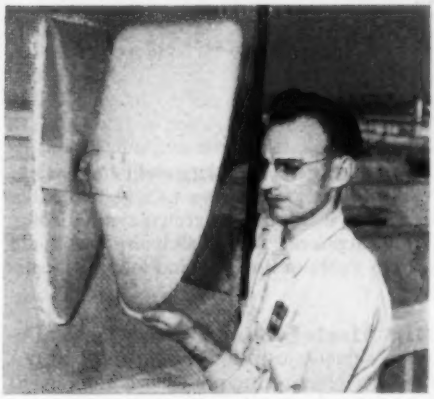
Plane Antennas Go Into Hiding

DRAG created by trailing antenna wires and stub radio masts has no place in high-speed flight. To get rid of it, engineers are hiding antennas in many ways—making them part of plastic canopies, putting them in recessed slots, building them as a part of a plane's contour.

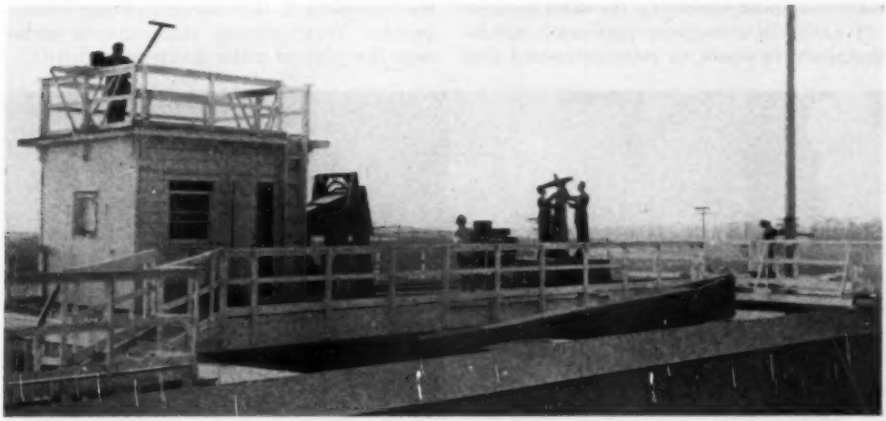
One trick is to stick them in fin-shaped cases like the Douglas designs pictured here. Thus encased in what is actually a low-drag airfoil, even a projecting antenna is no longer a hindrance.



Tiny, all-purpose antenna projects from turtleback of the model Skyraider shown here on a test stand. It creates little drag and is safe from high-speed flutter that might rip it off.



Composite antenna, capable of handling a dozen signals at once, is designed for mounting on the tip of a plane's vertical stabilizer. The wire cloth behind it helps in reception tests.

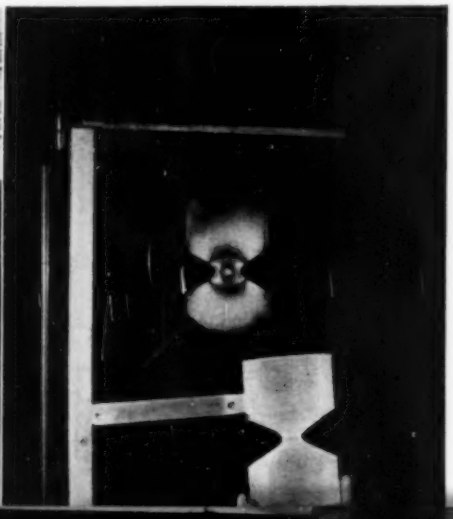


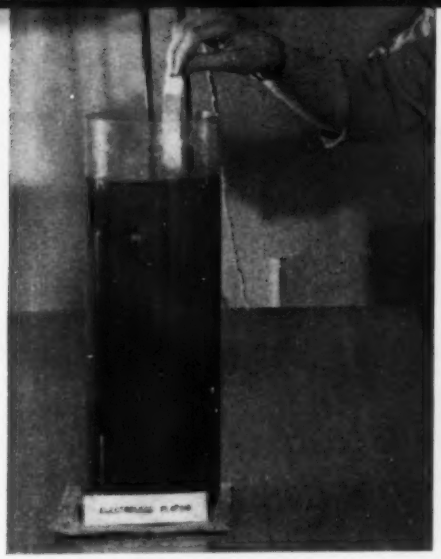
Roof-top laboratory at Douglas plant tests new antenna shapes. Angled horn beside building sprays model planes with broadcasts of various frequencies to learn best positions on plane.

Army Grows Biggest Crystal. The 15-lb. crystal above is said to be the largest of its kind ever grown synthetically. Army engineers at Fort Belvoir, Va., made it from thallium bromide and iodide. Transparent to infrared rays that optical glass stops, the crystal will be used to make special lenses and spectrometer prisms and windows. German wartime researchers developed thallium-compound crystals.

Big Models Get Color Test. Design engineers can now build king-size test models. The two big plastic cylinders at left below are shown in comparison to what was formerly the biggest usable slab, 1¼ inches thick. A modified form of Fosterite ⓕ can be cast in chunks 10 to 20 times larger than resins previously available for such models.

A model of a machine part—such as turbine shaft, flywheel, or rotor—is heated and strained in the same way the original would be in use. It is then cooled before the strain is removed and the stresses are "frozen in." As shown at right below, you can see these stresses as color patterns when you look at a slice from the model by polarized light. A slice of a strained specimen is in the foreground. Knowledge of the strains enables Westinghouse engineers to redesign the part to make it stronger.





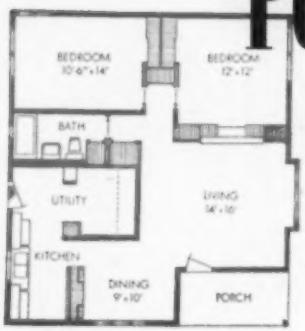
Plating Without "Juice." Nickel plating now requires no electric current. A chemical method developed by the National Bureau of Standards uses the action of hypophosphite on a hot solution of a nickel salt to form a hard metallic coating. This particularly simplifies plating cavities and the insides of tubes, where electroplating requires a centered internal electrode and special current leads. Demonstration rig, above, uses current only for a heating element.

Sniffs Gas Leaks. This GE electronic "pistol" spots a leak of as little as 1/100 ounce of gas a year. Air drawn into a sampling tube hits a hot anode emitting positive ions. If a halogen gas is present, the anode's ion output rises, and the tube's current output jumps, giving a visible or audible signal. With freon, chloroform, or other gases containing a halogen—fluorine, chlorine, bromine, or iodine—as a tracer, the pistol can find leaks in tanks or pipes.

Ship-Hider Fights Bugs. Once used to screen warships, this mobile fog generator has been adapted to attack insects. Mounted on a jeep, as shown below, it emits a dense white vapor over lawns, hotel grounds, camp sites or farm lands. The insecticide is said to reach corners that sprayers miss, and to do the job at about 1/20th of previous costs.

Inside the generator, developed and adapted by Todd Shipyards Corp., a blast of hot air atomizes the DDT solution and projects it through a swivel nozzle. Veterans have built a profitable business "custom-fogging" yards of homes in mosquito-plagued districts at $1 to $1.50 a treatment. With an extension hose on the nozzle, the same machine rids the interior of a building of flies, termites, bedbugs and spiders. Periodic treatments keep an area free from pests.

Porcelain Skin Protects Prefab



Built for comfortable living, the new Lustron house has an upkeep cost that goes easy on your pocketbook.

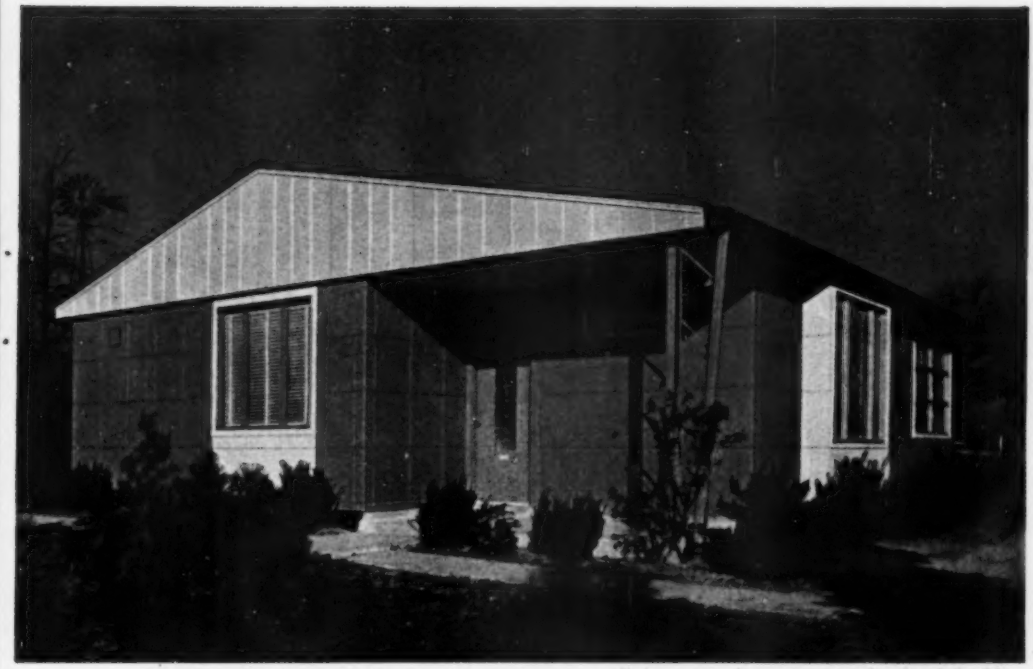
NO REPAIRS, no redecorating, no painting—that's the claim made for the Lustron ® house, a new type of prefabricated home. Its inside and outside walls are made of porcelain-enameled steel panels fitted to an all-steel framework.

The manufacturer, Lustron Corp., of Columbus, Ohio, says the panels will not scratch, crack, rust, fade, corrode, or deteriorate in any way. An over-all soap and water treatment will give you the equivalent of a painting or redecorating job.

The interior walls are double, to provide ample storage and closet space. A bedroom wall, for example, has two double clothes closets, a shelved closet, built-in mirror and dressing table, several drawers, and 48 cubic feet of extra storage space.

The company expects to turn out 30,000 of the homes a year. The price quoted for a five-room-and-bath house is $7,000 erected and ready for occupancy. This includes bathroom fixtures, plumbing, and electric wiring; lot and landscaping are extra.

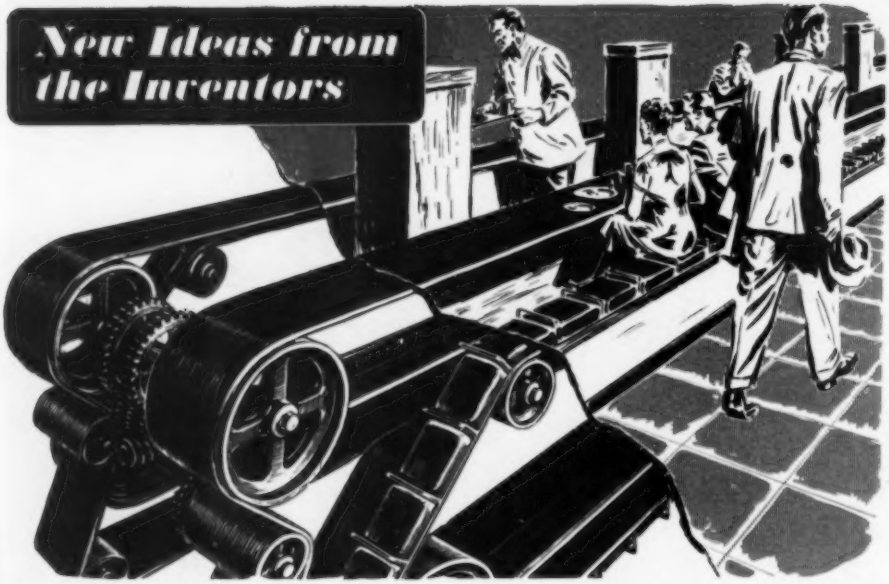
Ceiling panels are locked together with tongue-and-groove flanged edges. Heat from the furnace is forced into a six-inch space above the panels, extending over the entire ceiling. The panels absorb the heat and radiate it downward. The house is built on a reinforced concrete floating-slab foundation. Exterior wall panels have 1½-inch-thick spun-glass insulation.



Exterior of the new Lustron house is an adaptation of modern ranch-house design. It has two bedrooms, living room, dining room, and kitchen. Covering an area 35 by 31 feet, it will be erected on the site by local builder-dealers in less than 100 man-hours. Purchasers will be offered a choice of six different interior arrangements and six color combinations.

Typical living room, showing built-in bookcases. Another feature of the house is an automatic clotheswasher-dishwasher built into the kitchen sink. An oil-fired (or other type) heating plant is in a utility room next to the kitchen that can also be used for drying clothes. Porcelain-enamel wall finish is unaffected by sunlight, salt water, chemical fumes, or smoke.

New Ideas from the Inventors



Mechanized Restaurant. Assembly-line feeding is the object of this novel lunch counter. Diners, seats, and counter would all move slowly down each side on endless conveyer belts, while different courses of the meal are served along the way. Dumb-waiters carry up the food from a kitchen below. Its English inventors, T. Lewis, E. Rounce, and C. Dunham, claim the device will increase serving capacity.

Brush Scraper Fits Can. This handy brush scraper might not improve your painting, but it would keep your paint cans neater. Invented by Robert Ferguson, of Bristol, Tenn., it clamps onto the top edge of the can and prevents the excess paint, scraped off the brush, from running over the side. It can also serve as a brush rest.

Thimble Guides Yarn. If you're a knitting enthusiast who likes to wrap the yarn around a finger to keep it taut, you'd find this spiral-ringed thimble a big help. Patented by Jeanette Lloyd, of New York City, it takes several turns of yarn and keeps it under even tension, preventing it from cutting into the finger or slipping off.

Crash Seat Cuts Impact. This safety seat swings upward in a crash to soften the impact and keep its occupant from being thrown forward. Designed for planes, trains, or buses, the seat is operated hydraulically by a pendulum valve whenever a crash or sudden stop swings the pendulum forward. Once the seat is up, bottom cleats lock to the back of the seat ahead, holding the occupant nearly horizontal. The inventor is Donald Henderson, of Hollywood.

Leg Rests Ease Kneeling. Greater comfort for workmen who must spend long hours on their knees is the claim for these strap-on leg rests, patented by Robert Ferguson, of Bristol, Tenn. Padded cups at the top cushion the knees, while supports at the bottom take the strain off ankle and instep by raising the feet and allowing them to remain in a normal position. When not in use, the supports can be folded against the shin pieces to keep them out of the way.

Crank Powers Water Sled. You'd have a hard time keeping Junior out of the water if he had this hand-propelled water scooter, invented by Ralph Bates, of Yonkers, N. Y. Turning the crank handles, like bicycle pedals, spins a small tractor propeller, pivoted in front for easy steering. Cork floats in front and back keep it afloat.

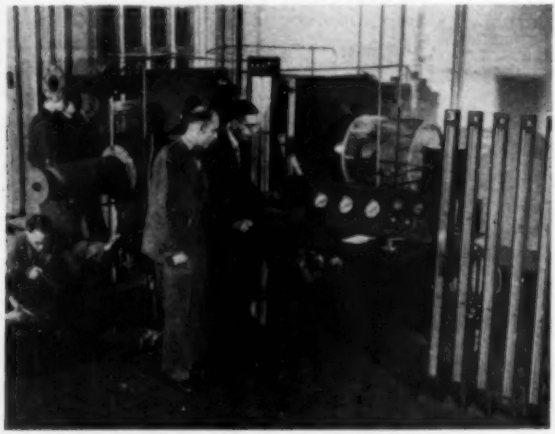
Jet Goes to College

JET propulsion is more than theory to engineering students at Rensselaer Polytechnic Institute, Troy, N. Y. They go from classrooms to a laboratory where they can study a working gas turbine at firsthand.

The equipment, designed by General Electric, is built around a war-surplus turbosupercharger from a B-29 Superfortress. It has a combustion chamber, compressor inlet flow nozzle, compressor discharge, control, and other accessories. Installed in the school's Mechanical Engineering Department, the unit is used to familiarize the students with the performance and characteristics of the gas-turbine cycle.

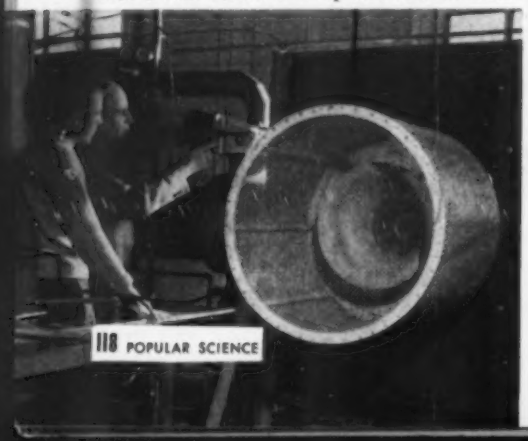
The equipment can also be used in the study of centrifugal compressor performance and air-flow measurement.

The turbosupercharger seen under arched protection guard is heart of the "educational gas turbine" at RPI. Above, Professor Neil P. Bailey is inspecting an instrument connection.

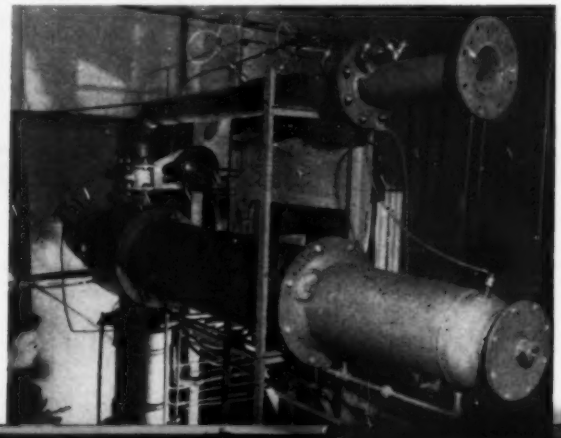


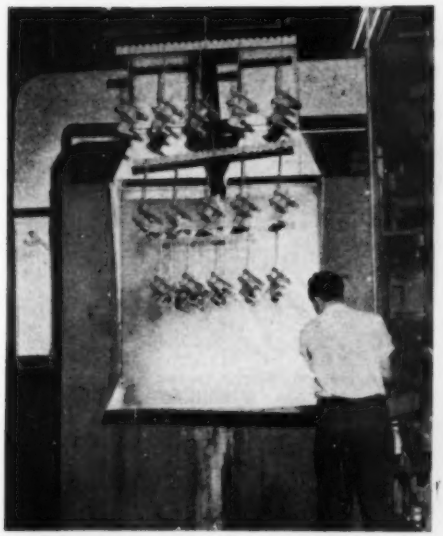
The gas-turbine equipment is installed in the laboratory of the school's Mechanical Engineering Department. Designers of the unit claim that it is the first educational project of its kind.

The operation of a jet power plant is explained to a Rensselaer student (below). In the foreground is the turbine's air inlet, covered with a wire screen to keep out dirt and dust.



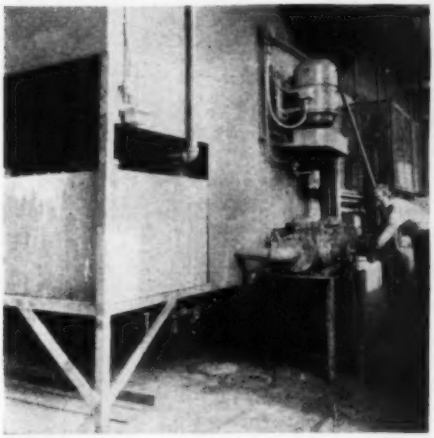
Students learn the fundamentals of gas-turbine operation by watching the unit go through its cycle. The long, horizontal pipe, at center below, is the machine's combustion chamber.





1. Parts to be finished go through the automatic painting machine on a traveling conveyer rack. Here they start the first step, entering a chemical bath that will clean them thoroughly.

3. Still-wet parts, now painted with an even coat of the right thickness, leave the drain tunnel for the electric baking ovens. A single piece is completely finished in less than two hours.



2. Inside this pressurized metal chamber, pieces are sprayed with paint. Then they move into a drain tunnel where excess drips off. Operator is adjusting thickness of paint being sprayed.

4. At the end of the line, human hands touch the parts for the first time since they entered the robot finisher. Cleaned, painted, and dried, the finished parts are now ready for assembly.

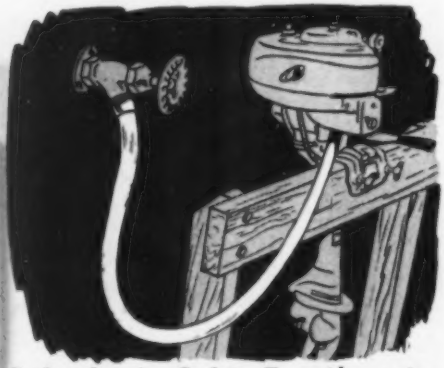
Robot Cleans, Paints, Dries

FEED an unpainted metal part into one end of this gigantic new GE machine and it will come out the other end completely finished. Now in operation at GE's control division at Schenectady, N. Y., the robot painter can handle 12,960 parts in an hour—cleaning, rustproofing, spraying, drying, and baking the pieces entirely by remote control. It even saves up the excess paint that drips off the parts and sends it back to the spray guns. Engineers spent two years designing the machine.

I'd like to see them make . . .

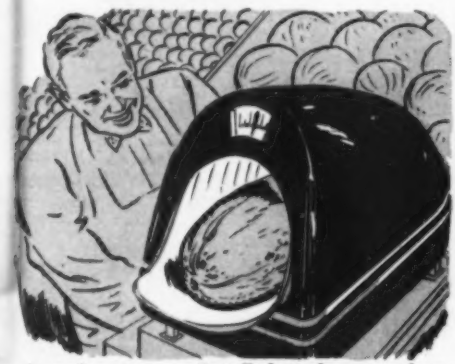
Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

Built-in straws. Plastic straws inserted in soft drinks at the time of bottling would be more sanitary than boxed straws. They'd have to withstand long immersion, of course.—*William Zolchak, Yonkers, N. Y.*



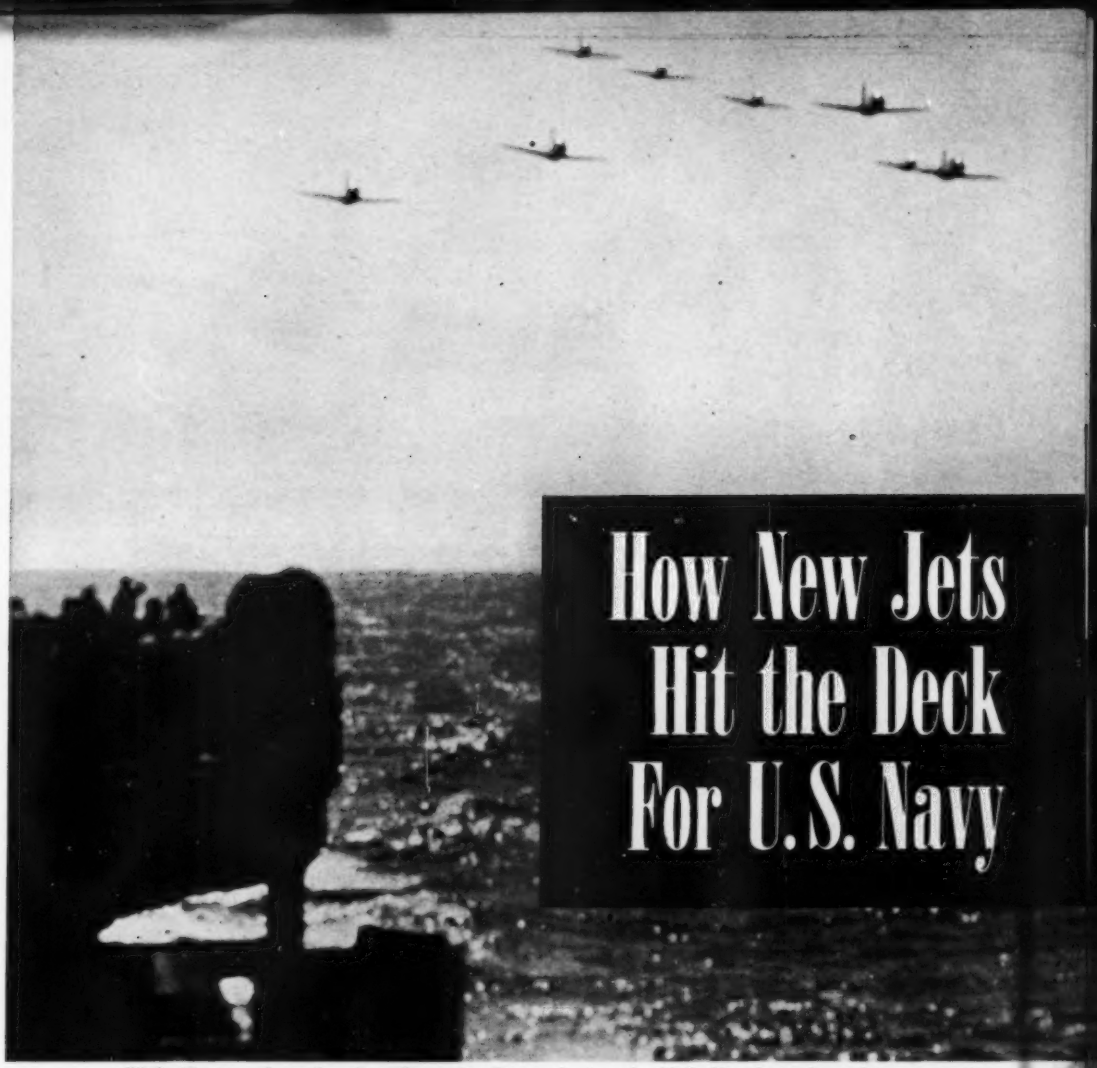
Outboard-engine flusher. To avoid corrosion of cooling systems, outboards are run in a barrel of fresh water after salt-water use. A garden-hose fitting and valve would make flushing easy.—*H. C. Vickery, N. Wildwood, N. J.*

Disposable umbrellas. Made of waxed paper on a cardboard frame, cheap throw-away umbrellas could be sold from vending machines in lobbies, ball parks and subway exits.—*Daniel M. Davis, Library, Pa.*



A melon tester. Installed in large markets, this gadget could give a sonic or electronic thump to a melon, with a dial to register "ripe" or "unripe." No more guessing.—*Roy Wakamiya, Lancaster, Calif.*

A window wiper. The wiper mechanism could be built into the door by the driver. Keeping this side window clear would be an added safety factor. Power might be vacuum or electricity.—*Ernest Greeson, Jr., Brooklyn, N. Y.*



How New Jets Hit the Deck For U.S. Navy

Eight Furies salute the aircraft carrier *Boxer* during the U. S. Navy's jet-launching operation.

Successful landings and launchings on a carrier at sea initiate jets as a part of our ocean-borne air force.

By Andrew R. Boone

FLASHING down over the fantail of the U. S. aircraft carrier *Boxer* one sunny day last March, a thick-bodied, thin-winged fighter hit the deck and slid to a stop in the grip of the arresting gear. A routine landing in all but one respect: the plane.

It was a shining new North American Fury—the first all-jet fighter ever to land on a carrier's deck under operational conditions at sea. Its arrival aboard the big Essex-class carrier off the California coast meant that years of Navy research and experiment had finally paid off in a new era of 10-mile-a-minute fighter sweeps for the fleet's air arm.

The historic landing was made by Comdr. Evan (Pete) Aurand, skipper of Fighting Squadron Five Able. Forty seconds later, Fighting Five's executive officer, Lt. Comdr. Robert Elder, followed Aurand in, setting his Fury down as soon as a squat deck tractor had tugged the lead plane beyond the crash barriers. For practical reasons, only these two of the squadron's planes landed in the initial test. But to make the trial complete, they took off under their own

Crewmen scurry away as the Fury, with Aurand at the controls, prepares for the first operational launching of a jet plane from a carrier deck. Six .50-cal. machine guns are mounted in the thin wings. With wing-tip tanks carrying an extra 300 gallons of kerosene added to 500 in fuselage tanks, the jet fighters will be able to stay aloft four hours and cover 1,500 miles.

Fighting Squadron Five's executive officer Elder (left) and Commander Aurand, who made historic jet-fighter landings on a carrier. Operation took place off the coast of California.

power and landed again, then took off a second time with the help of the catapult.

These and succeeding trial runs, which followed 200 landings on a make-believe carrier deck marked out on a California airfield, illustrated many of the factors that make seagoing jet operations a different business from propeller-powered flight.

As a striking force, a big carrier transports about 100 planes. Conventional fighters, taking off under their own power, can be launched every 15 seconds or so. Catapulting gets them off about a third as fast. In repeated tests, the Furies have shown that they can get aloft almost as quickly as propellered planes when deck-running, and about as fast when catapulted.

Jets don't accelerate rapidly at low speeds, so they need a longer run—the full length of the flight deck. Also, the roaring exhaust blasting back along the deck complicates the launching of several planes at a time, since it requires greater headway. Headway, which here means the distance (or time) between objects following one another along the same path, is a measure of effectiveness. It corresponds to the rate of fire of a machine gun.

Jets have one tremendous advantage over reciprocating engines: they need no warm-up. At any alarm, a jet can be moved from a deckload of parked planes, started, and launched at once. The *Boxer's* Furies were clocked aloft less than two minutes after their engines were turned on.

All this means that a special system of catapulting will probably be evolved to shoot jets off, perhaps with a moving-chain pickup delivering them to the catapult stations. Two catapults, one on each side of the flight deck, could get a squadron of 18 planes into the air in six to eight minutes.

Jato rocket units could be used, but experienced pilots don't expect it. Jato drenches the deck with smoke. Sometimes rockets fail, ruling them out as an absolutely reliable launching aid. If generally used, large numbers of the Jato units would have to be stored aboard a carrier in space that is already precious.

The jet pilots prefer the catapult, modern versions of which provide a relatively

A dramatic moment in aviation history: Aurand's Fury becomes the first jet plane to make an operational landing on a carrier at sea. Note the first thwartship arresting wire bringing the 11,000-lb. fighter, moving at 115 m.p.h., to a dead stop after a roll of only 50 feet along the *Boxer's* deck. Meanwhile a destroyer waits astern, just in case the Fury "hits the drink."

smooth start. A jet plane zooms from zero to nearly 150 m.p.h. in a run of only 93 feet on the "cat," but acceleration is no more than 2.5 G—"less," as Aurand points out, "than we suffer in a tight turn."

Jet landings present new factors, too. Coming home to roost, the pilots fly a different approach pattern. In a Fury, with no big radial engine up front to obstruct his vision, a pilot can see exactly where he's going. For the first time, he can see the crash barriers raised amidships on the flight deck to stop his plane if it bounces over the 12 arresting cables, stretched across the deck at 25-foot intervals.

"Actually," Aurand told a POPULAR SCIENCE reporter, "it's a little frightening to watch those barriers come up." But both he and Elder agreed that landing a jet on a carrier was easier than setting down a conventional fighter.

For all the differences in jet landings and take-offs, most of the major problems concerning jet fighters have been solved. On the basis of the *Boxer* tests, the Navy feels that only practical details remain to be worked out, and a broad expansion of the jet program is already under way.

Fighting Five will be fully operational this summer. On the East Coast, Fighting Squadron Seventeen is getting set for sea duty with McDonnell FH-1 Phantoms. These squadrons will provide a nucleus of trained pilots and crewmen for other groups.

Both Furies and Phantoms are considered interim models (their successors may be the faster and longer-range McDonnell

Towed to aft elevator, plane shown above is lowered to hangar below deck. After refueling and servicing, it will be moved to forward elevator and raised to flight deck for catapulting.

Mechanic works to free landing hook. After each landing during the trials, the planes were thoroughly inspected and completely serviced. These jobs were done in a hangar below deck.

Immediately after the first landing, a small tractor pulls Aurand's plane up the deck beyond the crash barriers. Within half a minute, Elder sat his Fury down on the same spot.

Landing speed of each plane is photographically recorded as it hits the wire. A camera mounted at edge of deck catches both plane and the split-second clock face shown above.

The Fury gulps 72 cubic feet of air a second through this great gullet. Unlike that on some other jets, the intake is not split. The duct runs in a straight line from the nose to the tail.

Nose-wheel gear of Elder's plane is being checked by crewmen immediately after landing. Elder took a wave-off on an earlier approach to give his skipper the honor of the first landing.

F2H Banshee and the Grumman F9F Panther), but they provide examples of what jet propulsion means to the U. S. Fleet. The Fury, for instance, has a top speed of "more than" 550 m.p.h., and climbs to its fighting altitude faster than a mile a minute. At cruising speed, it can cover 1,500 miles during a four-hour flight; at top speed, it can stay aloft a few minutes short of an hour.

Fine for fighters, jet propulsion has one well-known limitation: it is least efficient at low altitude. And since many attack missions are flown "just off the deck," it is not yet practicable to use all-jet attack bombers. Therefore the Navy is limiting its initial jet program to fighters. *

But the more versatile turboprop attack types may join the jet fighters, and eventually even the jets may be adapted to low-level operation. When that happens, the Navy's air arm can really cash in on the program begun by Fighting Five. END

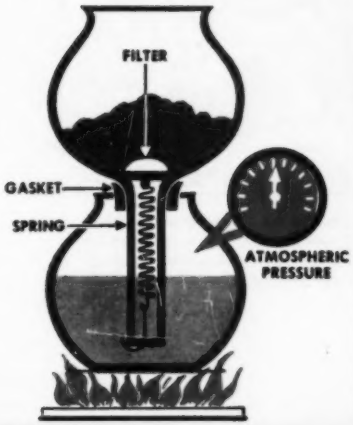
MECHANICS OF LIVING

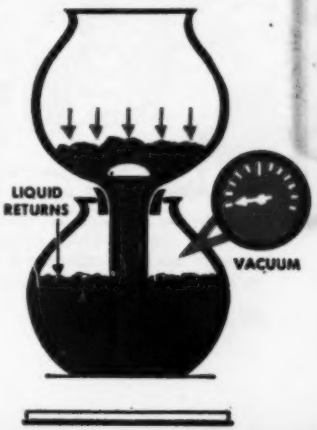
How a Vacuum Coffee Maker Works

The ordinary vacuum coffee maker is really a very scientific gadget. Cleverly using changes in pressure exerted by water vapor to mix water and ground coffee, it then filters the liquid off—and makes good coffee, too. At first, air space above water in the pot is near atmospheric pressure.

Heat converts some water into water vapor, or steam, which has no way to escape. Its pressure forces the water down and up the tube, through the cloth filter, and into the upper bowl. There it mixes with the ground coffee and is also stirred by bubbles of vapor coming up the glass tube.

When heat is removed, water vapor condenses, leaving pot practically empty—a vacuum. Air pressure then pushes liquid down through filter into pot. Filter lets liquid pass, but not grounds. Since some vacuum may remain, this Silex (T) pot has small lever on handle to help remove upper bowl.

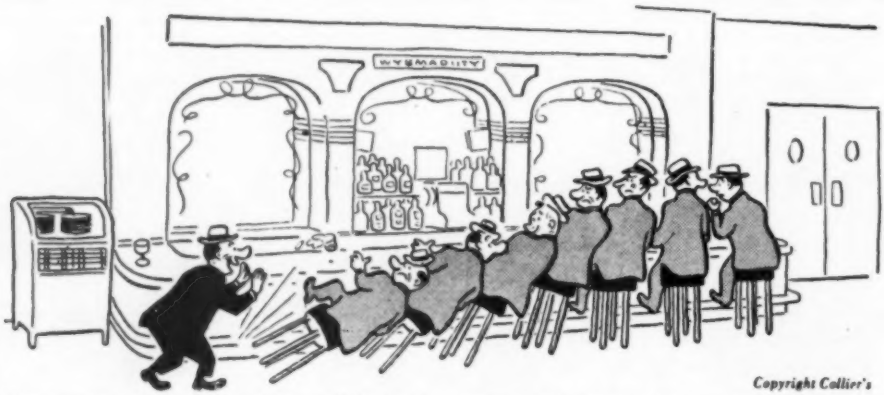




Cartoons Teach Physics with a Smile

A COLLECTION of more than 1,100 cartoons, clipped from newspapers and magazines over a period of years, enables Prof. Robert S. Shaw of the College of the City of New York to enliven his physics classes with apt and amusing illustrations. Often, his students find, a humorous analogy offers welcome aid to grasping a point in mechanics, optics, acoustics, or electronics.

Lantern slides made from his favorite cartoons conclude class periods. For reference, others are grouped by the points they illustrate in scrapbooks, covering with remarkable completeness such subjects as "Statics," "Heat and Sound," and "Molecular and Atomic Physics." Five examples are reproduced here, through the courtesy and by special permission of the copyright owners.

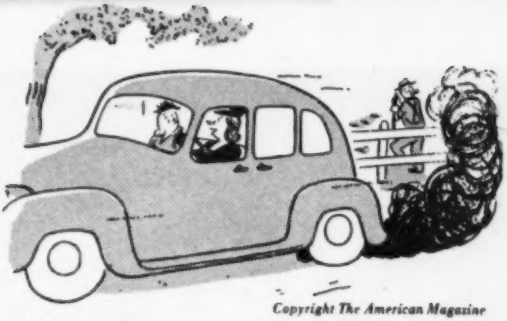


Copyright Collier's

Propagation of a wave is illustrated by Prof. Shaw, for students of mechanics and hydrodynamics, with this humorous analogy from his cartoon collection. Artist Colin Allen's original caption had the prankster saying, "I've always wanted to try this"—a commendable predilection, if indulged under more appropriate circumstances, for the experimental method.

The theory of isostasy, dealing with the tendency of equally massive blocks of the earth's crust to seek a common level, gets an assist with this clipping from the newspaper "funnies."

Cartoonist Ernie Bushmiller might be astonished to find his popular comic strip "Nancy" serving at the College of the City of New York to point up an abstruse principle in geology.



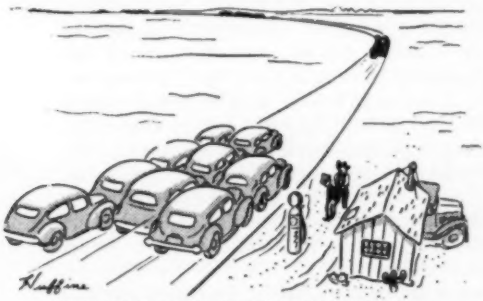
Copyright The American Magazine

"I always keep the emergency brake on just in case of emergency"

Friction converts mechanical energy into heat—as lady motorist, whose concern for safe driving exceeds her comprehension of machinery, unwittingly demonstrates in Stan Hunt cartoon.

Copyright 1940 The New Yorker Magazine, Inc. (The F-R Pub. Corp.)

But for the forces between the remote atoms of matter, one solid object could readily pass through another, and the fantasy of Charles Addams' captionless drawing could be fact.



"It's the 35-mile speed limit and that traffic light in Tucson
Copyright Collier's

Radar's klystron tube uses principle vividly illustrated by this cartoon. Cars traveling in clusters correspond to speeding electrons, similarly grouped or "bunched" in vacuum tube.

Photo by Western Ways

Cable-Eating Gophers Foiled at Last

TO THE gopher perched on this cutaway section, an A. T. & T. coaxial cable is an appetizing meal—even though it is buried six feet deep and has an exterior sheath of lead, phenolic and jute wrapping, and steel and copper tape covering the conductors.

Almost as soon as brand-new cables for transcontinental phone calls were laid west of the Mississippi, where gopher land begins, the burrowing rodents began disrupting service with short circuits and crossed lines. They gnawed right through all the layers.

Experimenters then offered captive gophers a diet of cable sections packed in earth-filled cans. Inner wrappings of .005-inch and .007-inch copper tape failed to stop them. Finally, .010-inch copper tape proved too much for all but one extra-sharp-toothed gopher. The scientists settled for that, and today this tape stops all but the most determined gophers from cutting in on your call.

Like many other noted scientists, Dr. Vannevar Bush, head of the Army-Navy-Air Force Research Board and president of Carnegie Institution, is an accomplished craftsman at home.

Top Scientist Has Own Shop

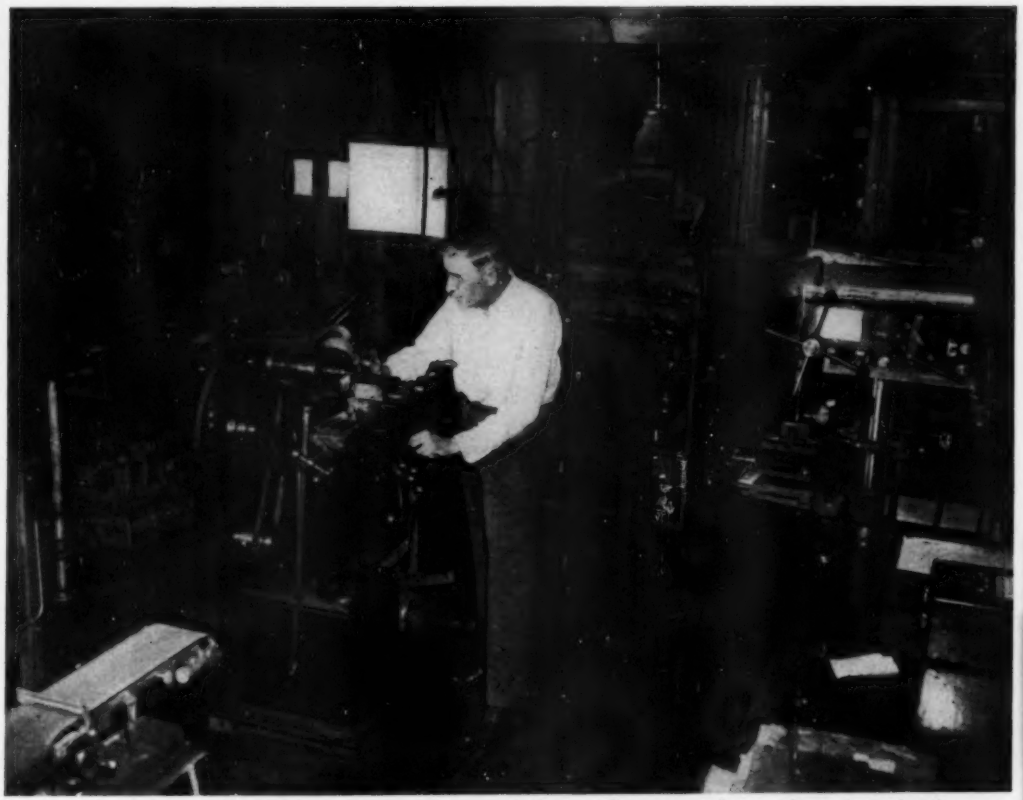
Vannevar Bush relaxes from running the Carnegie Institution by running power tools in his own basement.

By John F. Loosbrock

A BRILLIANT scientist uses his hands to get his facts and prove his theories, just as a skilled artisan uses his head to get the most from his hands and machines. Vannevar Bush is one of the top-ranking scientists in the country—president of the Carnegie Institution, wartime director of U. S. research, holder of an impressive string of degrees, medals, and patents. He is also a top-ranking craftsman, living proof of the kinship between science and workmanship.

A veteran of 45 years of home craftsmanship, Dr. Bush has spent 30 of those years collecting the formidable array of power tools that crams a 14 by 20 room in the basement of his Washington home. And he spends every spare moment there.

The war, during which Dr. Bush ran the Office of Scientific Research and Development, put a crimp in his home life and he stored his tools and equipment for the



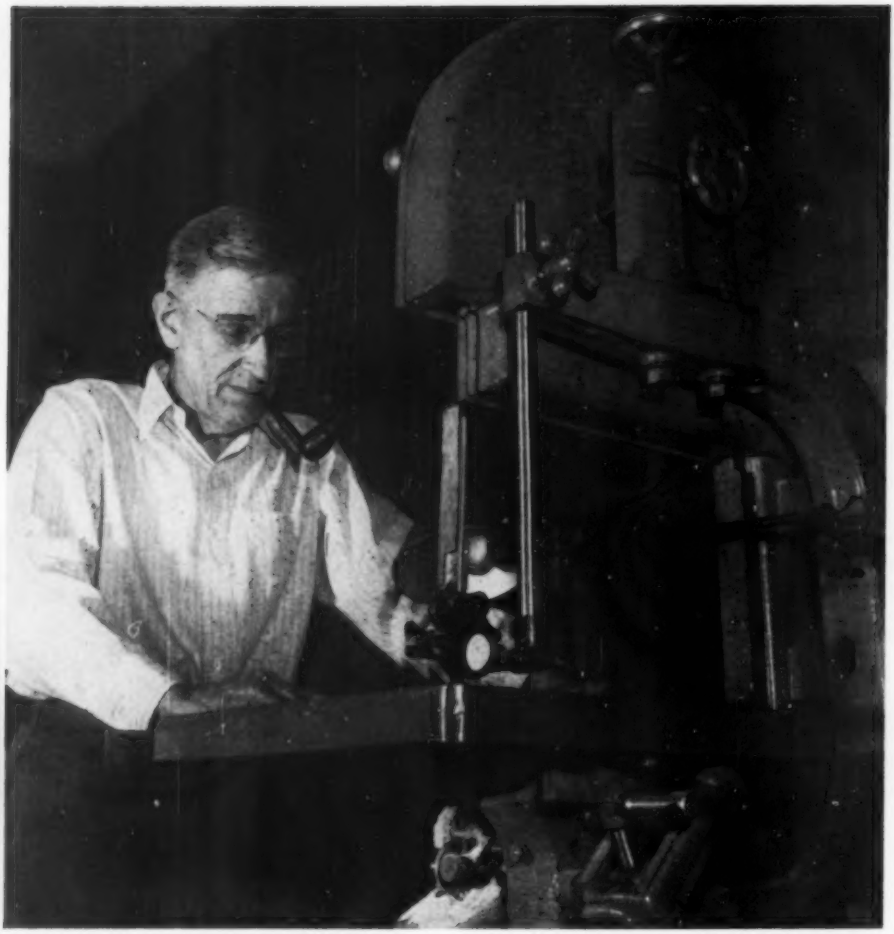
In the well-equipped basement shop of his home in Washington, Dr. Bush specializes in making unusual scientific gadgets that have not been made before, at least in home workshops.

duration. After VJ-day he dusted them off again, but with the scientist's eye for precision he spent the weekends and odd moments of almost two years in arranging his shop, installing built-in cabinets for attachments and gadgets, before he did much actual work.

Compared to the average home workman, Dr. Bush's output is small, partly because he lacks leisure and partly because of the difficult tasks he sets for himself. He has two criteria for his projects: preferably, they are some precise scientific gadget that no one has ever made before, at least at home; or they are made in a unique way. For example, his biggest postwar project has been the production of a set of optical flats—three Pyrex ® glass disks, six inches in diameter and three-quarters of an inch thick, ground and polished to a precise flatness varying no more than one-tenth of a wave length of red light, or two-millionths of an inch. You don't turn those out in one evening!

A typical Bush touch in the workshop is a set of sliding plywood panels, or false walls, hung on overhead tracks along one wall. The panels contain the attachments for the various machines, such as the drill press, milling machine, and band saw. The proper panel can be shifted on the tracks to be near the particular machine he is using. Dr. Bush has altered much of the machinery to fit his own needs. Most of the changes either give a greater range of speeds or make it more convenient to shift from one speed to another.

Besides being a top government scientist and administrator, Dr. Bush is an inventor of no mean stature. His inventive interests have for years been focused on harnessing mechanical and electronic means to do more

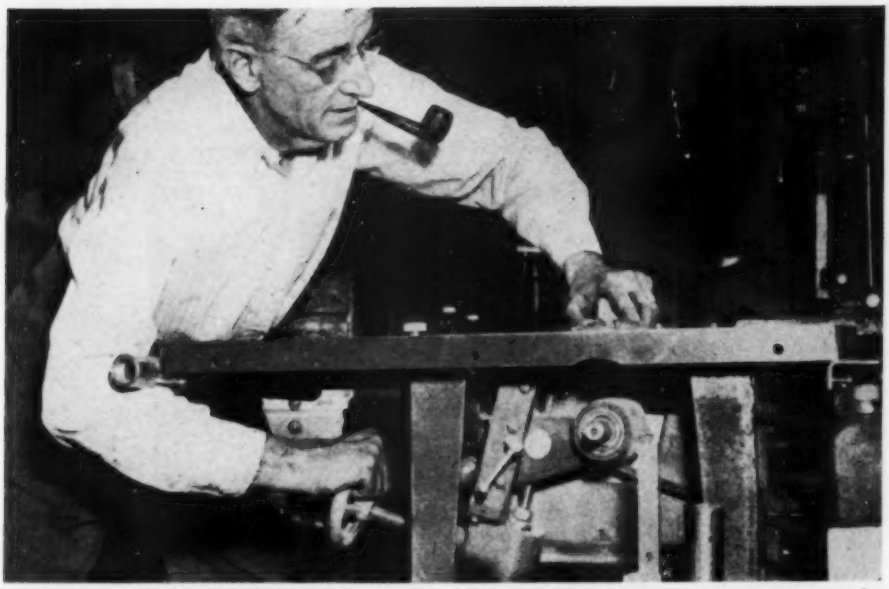


Wartime duties as director of the famed Office of Scientific Research and Development kept Dr. Bush so busy that he only recently returned to his hobby machines, such as this bandsaw.

and more of man's computation, calculation, and repetitive routine for him, leaving more time for just plain thinking.

For example, at Massachusetts Institute of Technology in the late 1920's Dr. Bush developed a network analyzer, which set up in miniature a large electrical power system so that its performance could be tested under stress. Another product of his interest in tools to free man's intelligence for creative effort is the differential analyzer. One was begun at MIT under his direction in 1935. Ten years later it was made public after working on war problems for some three years. The machine weighs 100 tons, combines some 2,000 electronic tubes, several thousand relays, about 150 motors, and nearly 200 miles of wire. It solves differential equations expressing mathematical problems with as many as 18 variables.

Other Bush devices include the rapid selector, which scans and selects wanted items from microfilm, and a justifying typewriter, which produces typescript with an even right-hand margin in a single operation. Another idea, which has not progressed beyond the fanciful and speculative stage, is a sort of a mechanical memory (Dr. Bush calls it the "memex") that would flash on a screen all the data a person has collected on any subject at the push of a button. END



Dr. Bush is seldom satisfied with his machine tools as they come from the factory, and generally alters them to give more precise, simpler adjustments and a greater range of speeds.

An example of the Bush-made attachments is the power take-off arrangement (the belts and pulleys on the wooden frame at right, above) he has added to this standard milling machine.

Records are preselected by adjusting into one of four positions the lever beneath each of 100 records in the library. First position plays "A" side of record, second "B" side, third both sides. Fourth position lets pickup skip record and move on to next. At bottom of cabinet, left to right, are controls of power amplifier, dual-line outlet to distant speakers, and AM-FM radio. All but record selection can be run by remote control. Cabinet is 52" x 37½" x 27½".

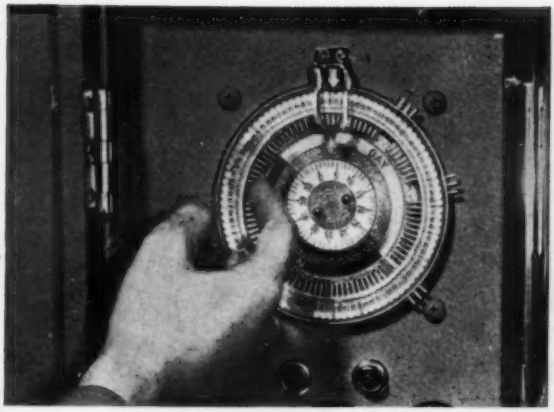
How New Phonograph Runs Itself All Day

PS photos by Hubert Luckett

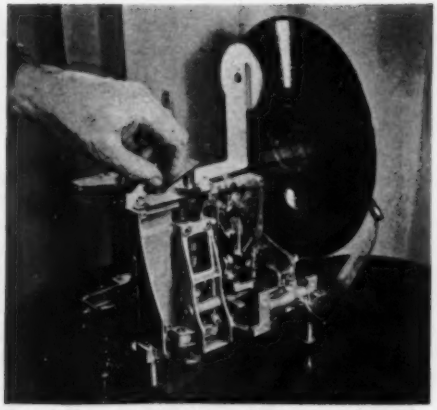
THIS phonograph can play for more than 14 hours without repeating a selection—and without a hand touching it. What's more, it can turn itself on and off at pre-set intervals any time of the day or night.

After a few manual settings, the new Select-O-Matic 200 Library Ⓣ does its own thinking. A mechanical "brain" on a track behind a rack holding 100 records (200 sides) goes to the desired disk, lifts it to a turntable, and plays either or both sides. When finished, the record is returned to its slot, and the player carriage moves to the next selection. Ordinary 10- and 12-inch records may be intermixed in the rack. Once filed, they need never be touched until replaced.

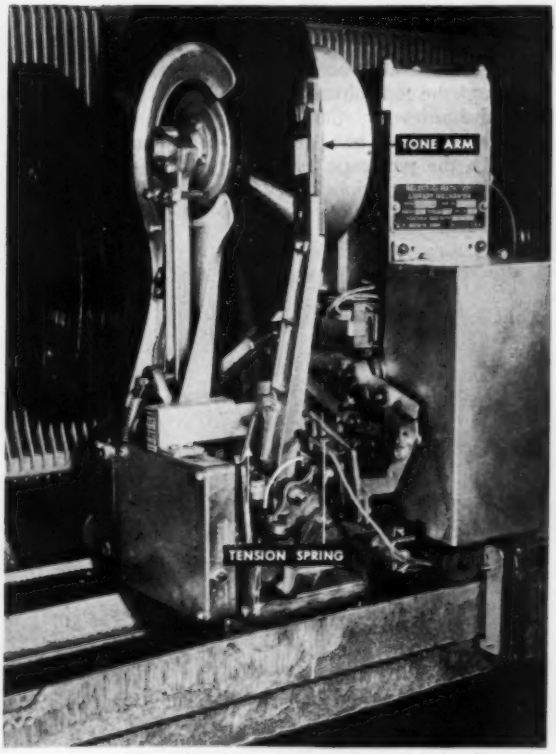
The industrial model shown here was designed primarily for factories: it has been found that music boosts morale and reduces fatigue. A whole week's programs of 15-minute concerts once each hour of an eight-hour day can be laid out in advance. It can also be used in clubs, department stores—even dance halls. Optional are an AM-FM radio and an amplifier for remote-speaker outlets that can double as a public-address system. The maker, J. P. Seeburg Corp., of Chicago, also produces a home set, complete or to be plugged into a radio.

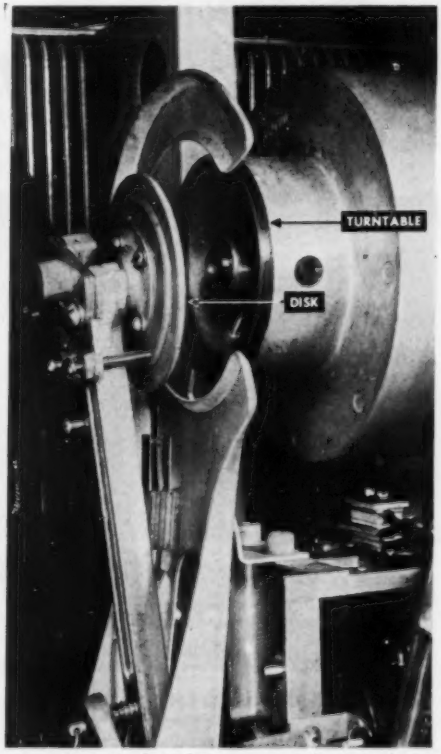


By setting the program timer, calibrated in 15-minute intervals, the operator can choose in advance the periods when the Select-O-Matic Ⓣ will automatically start and stop playing.



Hand-operated mockup of phonograph mechanism shows how an arm picks out a record and pushes it toward the turntable, represented in the photograph by the white disk.





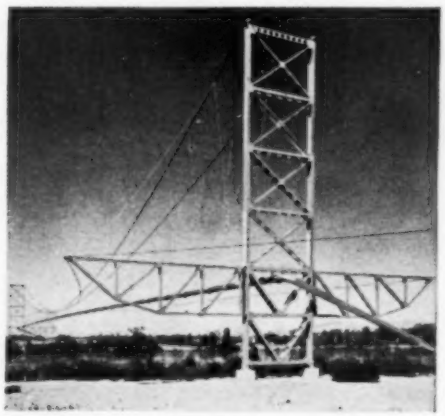
"Brain" of the player, located behind the library, travels along a track until it reaches record to be played. A system of levers then pulls out record onto vertical turntable and sets tone arm into position, above left. To play the opposite side of the record, the mechanism returns it to its slot, the tone arm then pivots to the right, the record comes out again, and the stylus on the left side of the tone-arm head is held against the record by tension springs. Close-up, above right, shows turntable. Disk with spindle centers record, clamps it to turntable.

Curb Bank Uses Mirrors

CURB service has moved from hot-dog stands to banks. You can drive right up to this Curb Teller Ⓣ and do your banking without ever leaving your seat. Developed by Duplex Electric, the bullet-proof curb-side unit (above) holds a two-way intercom and the top mirror of a periscope. Below the sidewalk, the teller is protected against bandits, but can see his clients through the periscope and talk to them on the intercom. Money and bankbooks are exchanged on a small electric elevator.

Guillotine Cuts Planes

THIS modern guillotine is speeding the salvage of wrecked and obsolete airplanes at the Naval Air Station, Norfolk, Va. The huge, 6,100-pound blade slices its victims into small sections, which are then melted down, cast into ingots, and sold at auction.



Gas Pipe Takes to Air

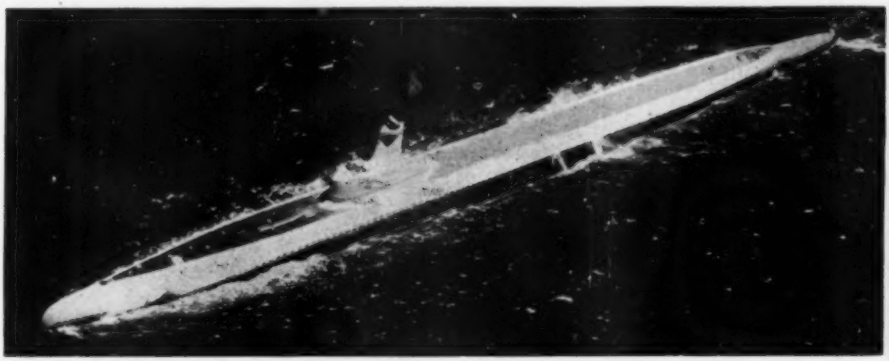
THIS big, 30-inch pipeline carrying natural gas from Texas to Southern California is getting a 1,038-foot lift across the Colorado River at Blythe, Calif. Two 116½-foot towers support the pipe, while horizontal trusses keep it from swaying in high winds.

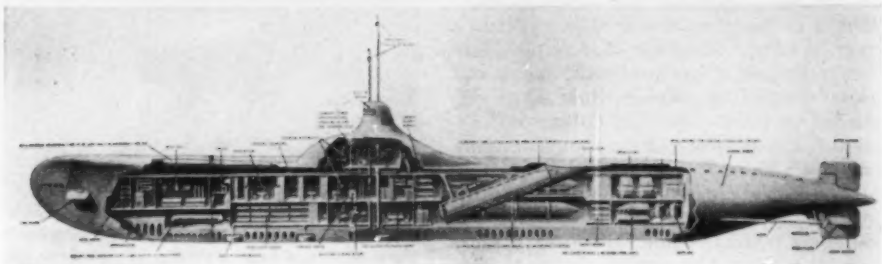
Streamlining Speeds New Subs

SLEEK as seals, these recently streamlined underwater craft provide a preview of what the best dressed submarines of the future will—and won't—wear. Designed to increase submerged speed by cutting underwater resistance, alterations on the USS *Pomodon* (above) and the USS *Odax* (below) include a reducing diet for the superstructure and the removal of deck guns and other topside mountings. Both have a new version of the German "schnorkel" breathing tube.

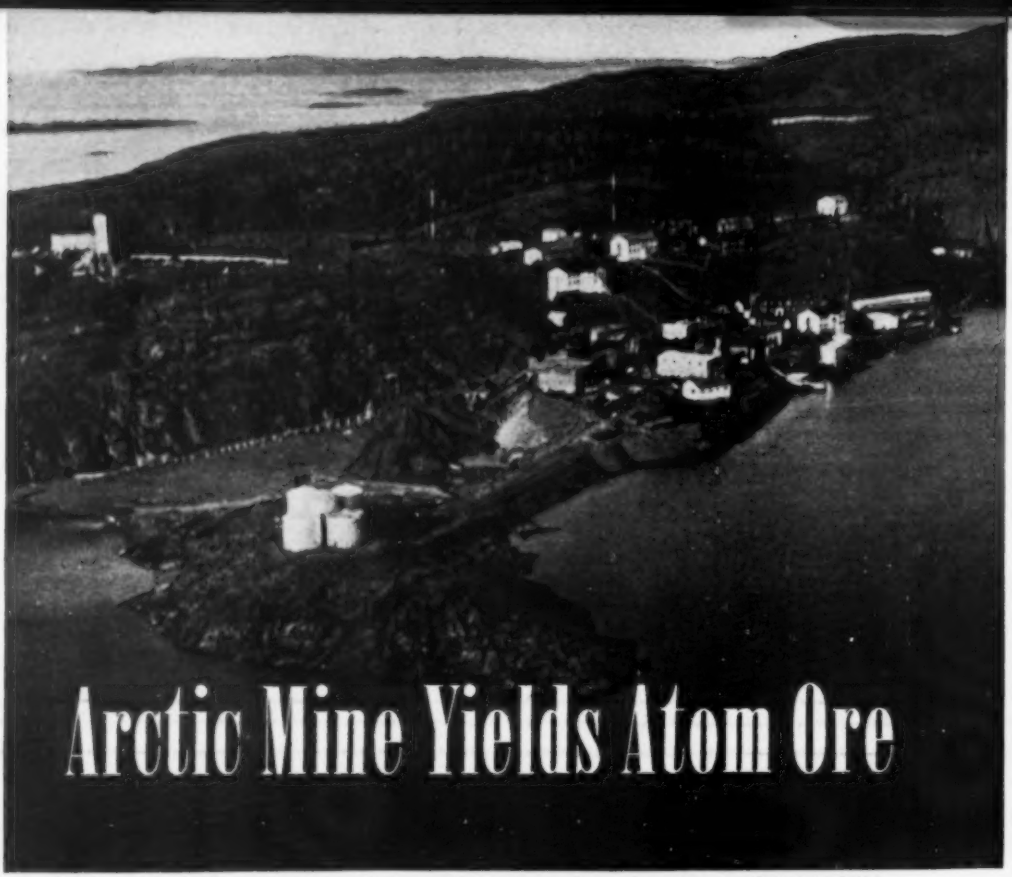
Submarines are said to be the naval type least vulnerable to atomic attacks, and these changes are part of an over-all program to bring our undersea service up to date in the light of recent research. Greater range and the ability to stay under water for long periods are two important objectives. Design changes will also improve the subs' resistance to the crushing effects of atomic bombs.

Operation of the altered subs is expected to help perfect plans for four new ones.





This inside view of a new type of submarine is reprinted from the April, 1947, issue of POPULAR SCIENCE. Provision has been made for the launching of jet-propelled, atomic guided missiles.



Arctic Mine Yields Atom Ore

Port Radium, site of Canada's rich radium and uranium mine, is on huge sub-Arctic lake.

THE most important mine in the Western Hemisphere—since that day three years ago when the atomic age began—is deep in Canada's Northwest Territories, only 26 miles below the Arctic Circle. From this desolate spot come great quantities of pitchblende, source of radium and uranium.

Now operated by a company controlled by the Canadian government, the mine at Great Bear Lake was discovered in 1930 by an Ontario prospector. Its prewar production of radium exceeded a million dollars a year in value. Since the start of the Manhattan Project, it has furnished huge, undisclosed amounts of uranium oxide. Once discarded as waste after the radium was removed, the oxide is now the source of uranium-235, raw material of atom bombs.

The Canadian mine is the richest in the world, furnishing pitchblende that is 40% to 50% pure uranium oxide. However, it ranks second in output to deposits in the Belgian Congo in Africa.—A. H. MITCHELL.

Pitchblende is mined the same way as coal. In photo above, a hole is drilled in rock face with pneumatic "stoper." Dynamite charges then blast loose the ore, and it is shoveled into cars.

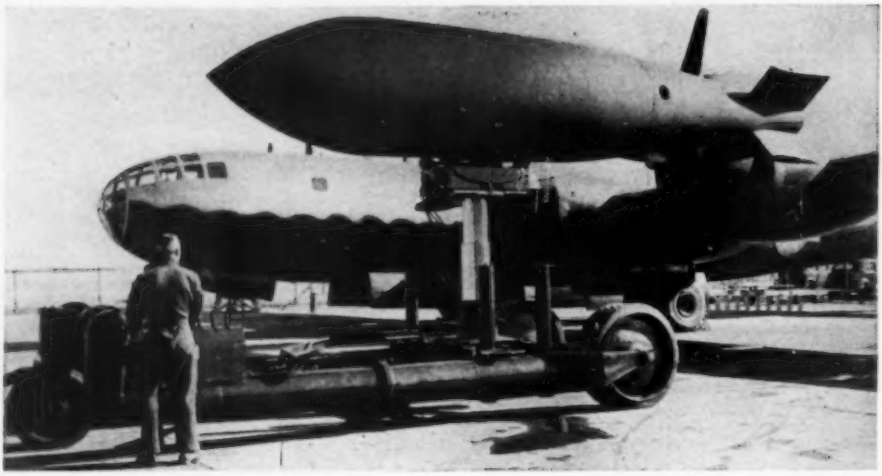
After an electric hoist carries the ore to the top of the mine-head tower, it rides a conveyer belt to the mill. Pieces must be broken and rock removed before the ore can be ground.

The powdered ore is concentrated by mixing with water and shaking the mixture on vibrating tables. Heavy pitchblende (uranium is the densest natural element) collects at one side.

This black powder is concentrated pitchblende, mostly uranium oxide. A ton of uranium oxide contains less than a hundredth ounce of radium, and about 12 pounds of atom-bomb U-235.

Final processing of the pitchblende concentrate into radium is performed in a plant 4,000 miles from Port Radium. In summer, the heavy sacks are carried by boat to the nearest railway.

The winter cold freezes Great Bear Lake, providing an excellent landing surface for planes that transport the pitchblende concentrate to Edmonton and bring back supplies during the months when water travel is impossible. Dog teams furnish the only other contact with the outside world, but are used mainly for communication with other settlements nearby.



B-29 Lays Biggest Egg

THIS 21-ton giant is almost twice as big as any bomb previously dropped from a plane. It recently hurtled from the modified bomb bay of a Superfortress at Muroc (Calif.) Air Force Base. It is a general-purpose bomb, 4½ ft. wide and 26 ft. 10 in. long. During tests a dud was used to obtain flight characteristics and to determine what happens to a plane in flight that suddenly loses 42,000 pounds.

To make room for the bomb, a portion of the plane's body section under the wing was cut away. The rear bomb-bay doors were removed entirely, and the front bomb-bay doors were cut away to allow the nose of the bomb to protrude. To load the huge missile, Boeing designed a special 50,000-lb. lift (shown above), operated by one man.

Gravity Aids Grocers

GROCERS' shelves are never bare when the Food-O-Mat Ⓣ is on hand. This self-service, gravity-feed food dispenser rolls or slides canned, bottled, and packaged groceries practically into shoppers' waiting hands. As one item is removed from the end of a slanted chute, gravity pulls down another, saving shoppers' time and insuring freshness. Filled from the rear (right), it keeps stock and clerks behind the scenes, is said to save up to 50 percent in floor space and personnel. Made by the Grand Union Co., the 84-foot unit comes in 24 sections, each 3½ feet long, and can hold 1,900 separate items.

Great size, great precision, and great speed are combined in this new steel-strip rolling mill.

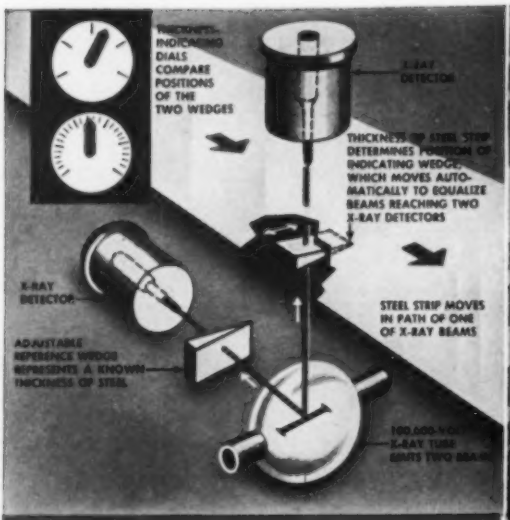
Mill Rolls Steel At 70 Miles an Hour

By Alden P. Armagnac

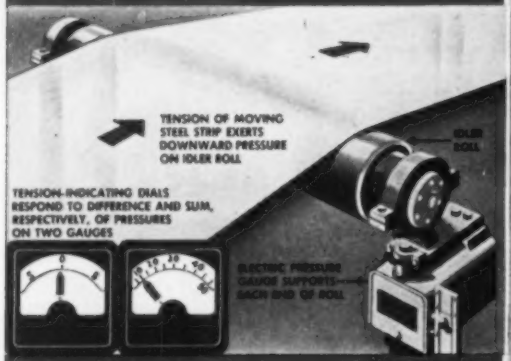
THE mechanical monster above is steel's fastest rolling mill. It is also the most powerful, the biggest, and the heaviest of its kind. Since speed increases the uniformity of the product, this mill not only shoots out more but also better steel strip.

Recently placed in service at the Aliquippa, Pa., plant of the Jones & Laughlin Steel Corporation, the mill turns out the thin steel that is tin-plated and used in cans.

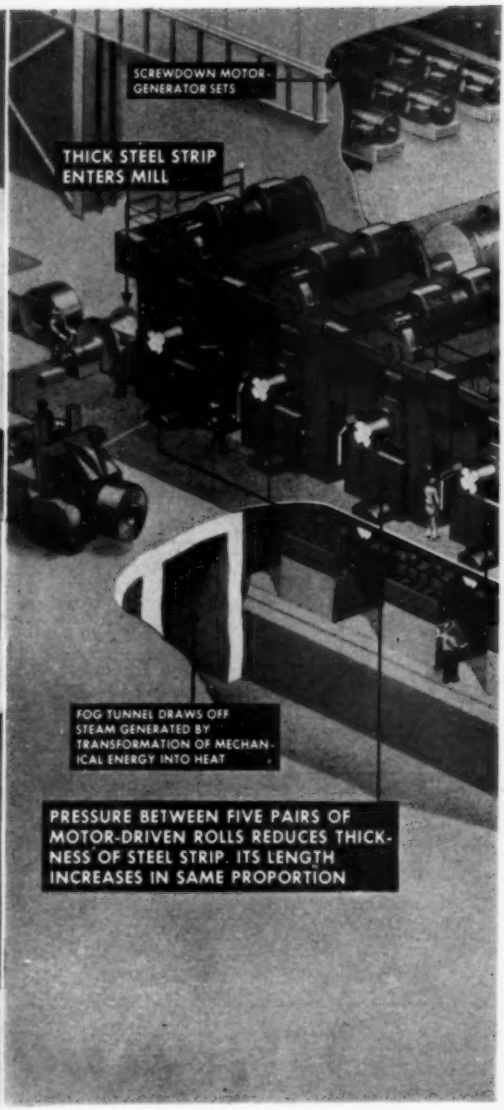
Steel men call the machine a "five-stand tandem cold strip mill." It weighs as much as a couple of destroyers. Its reinforced concrete piers go down 50 feet to bedrock.



Novel features of fastest steel-rolling mill, shown in large drawing at right, include X-ray thickness gauge above. It measures final thickness of the flying strip without touching it.



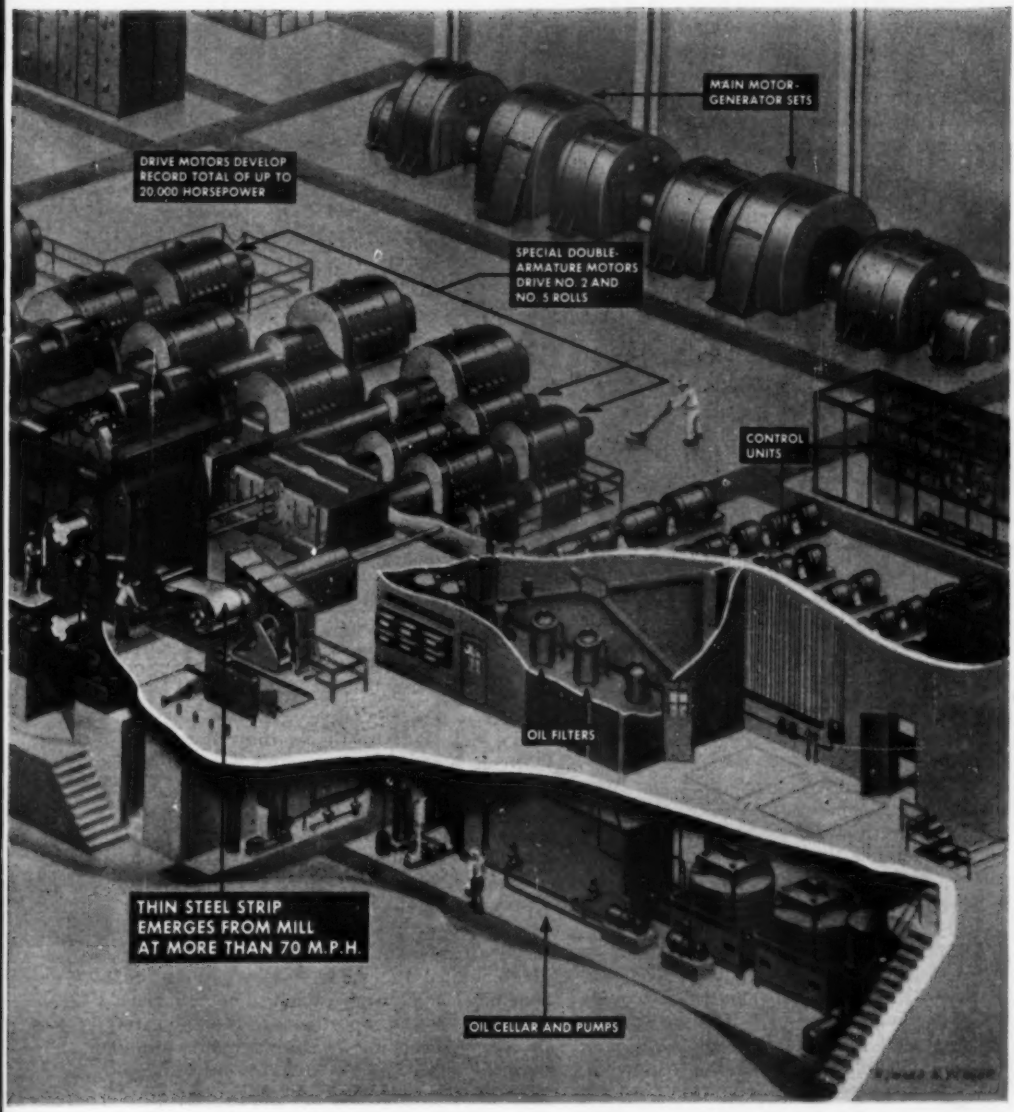
Tension on strip at five key points is shown by electric tensiometers like one above. Excess tension on either edge registers on left-hand dial, and total tension on right-hand dial.



Yet the 4,000-ton giant is so delicately responsive to its controls that it can be regulated with micrometer precision. Experts credit the builder, the Mesta Machine Company of West Homestead, Pa., with a major advance in the art of steel making.

A mouthful for this steel-hungry giant is a 15-ton, 5½-foot-high coil of the thin metal that the industry calls steel strip, measuring about 1/11 of an inch thick and two-thirds of a mile long. By applying terrific pressure, wringerlike motor-driven rolls reduce this material to 1/100-inch thickness, or about one-ninth of its original gauge. Since the rolling increases its length in the same proportion—nine times—the product is a six-mile-long ribbon, which winds up into a coil of the same weight and over-all size as the one fed in. Widths up to 36 inches may be rolled.

A whole coil takes only five minutes to hurtle through the rolls. At this express-train



speed, the new mill would require less than an hour to roll a 30-inch-wide band long enough to reach from Pittsburgh, Pa., to Youngstown, Ohio.

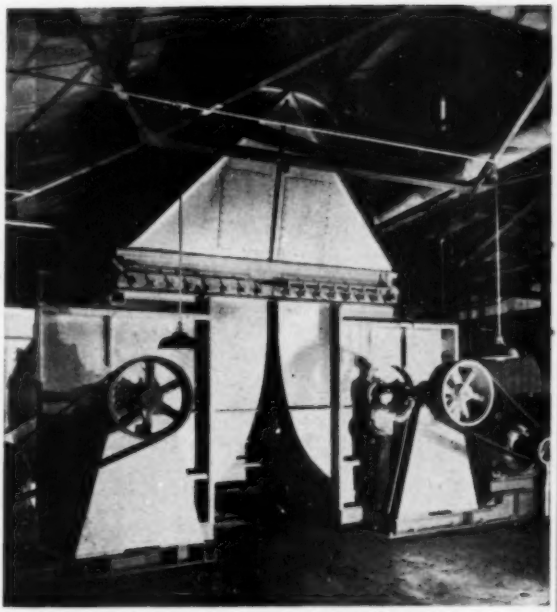
So much mechanical energy turns into heat in kneading the metal that it takes a torrent of water to cool the massive rolls. The steam generated would hide the machine in a blanket of mist but for a special fog-elimination system that sucks away the vapor-laden air through a tunnel and exhausts it through a stack to the outdoors.

Eight giant drive motors, which together can develop more than 20,000 hp. continuously without overheating, make up the largest power plant ever harnessed to a cold-rolling mill. By using twin armatures in tandem on a single shaft for the three most powerful motors, General Electric designers avoided the excessive inertia or "flywheel effect" of big rotors. This enables the mill to be started and stopped with phenom-

enal speed. It accelerates from a pace of 300 to 4,500 feet per minute, or from 3½ to 51 miles an hour, in just six seconds. Auxiliary motors operate "screwdowns"—the mechanisms that adjust roll spacing to determine steel thickness—of record power and quick action.

Each passage between a pair of rolls—there are five in all—lengthens and speeds up the moving strip. To do this, each successive pair must revolve faster than the one before. Speed control of exquisite accuracy strikes a delicate balance between taking up the slack and avoiding excess tension that would break the thin strip. Rotating electrical devices called amplidynes individually regulate the great drive motors, and instantly detect and correct any variation from their assigned speeds.

Steel is fed to mill and delivered in coils like these. Cross sections below them show actual thickness of raw material and finished product, and relative length before and after rolling.



Fog elimination system uses two 75-horsepower fans, above, to exhaust steam generated from cooling water by the enormous amount of mechanical energy that the mill turns into heat.

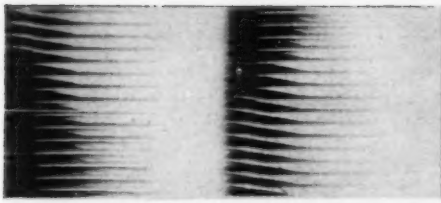
Along the right of way for the flying ribbon of steel, like the signal system that safeguards high-speed trains, ultramodern instruments aid the "dispatchers" who watch the control panels.

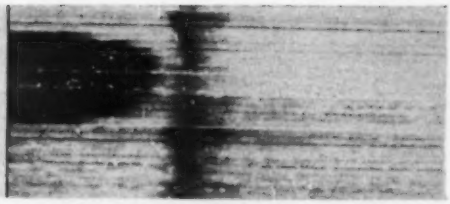
To warn of uneven or excessive pull on the strip, a device called an electric tensiometer is mounted between every two sets of rollers, and between the last one and the delivery reel. As a "feeler," this instrument uses an idler roll, over which the strip makes a slight change in direction. Consequently the tension of the strip pushes down against the idler roll, which rests at each end upon an electrical pressure gauge. Too much tension at one edge of the strip means a difference between the pressures on the two gauges, and registers on an electric dial. The total tension on the strip, the sum of the pressures on the two gauges, registers on another dial.

An X-ray thickness gauge checks the thickness of the finished strip "on the fly" as it speeds from the last stand to the delivery reel. Ports in the housing of a 100,000-volt X-ray tube, mounted beneath the strip, emit two beams.

One of these X-ray beams falls upon a detector—a photo cell with a fluorescent coating—after passing through an adjustable "reference" wedge of steel preadjusted to represent metal of a given thickness. The other X-ray beam falls on a similar detector after passing, in turn, through a movable "indicating" wedge of steel and the speeding strip itself. Each detector generates a current proportional to the intensity of X rays reaching it, and a motor automatically balances the currents by moving the indicating wedge back and forth. Thus the position of the indicating wedge for current balance depends upon the difference between the thickness of the steel strip going through the mill and the thickness of steel represented by the reference wedge. Dials indicate the position of each wedge, and comparison of their readings at any moment shows the thickness of the strip.

Today the world's hunger for steel and steel products is straining every facility. The Aliquippa mill is rushing to meet its share of the demand—rushing at 70 m.p.h. END

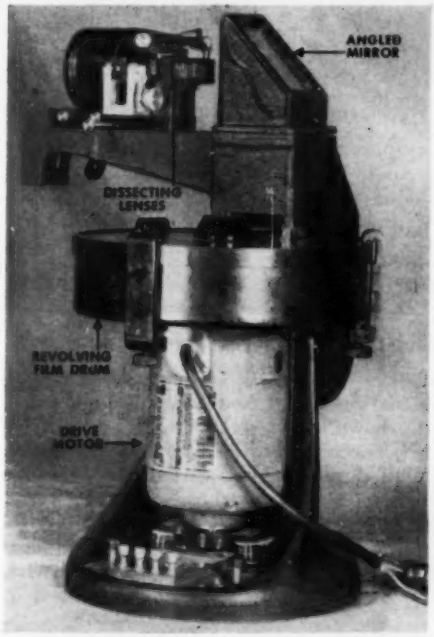


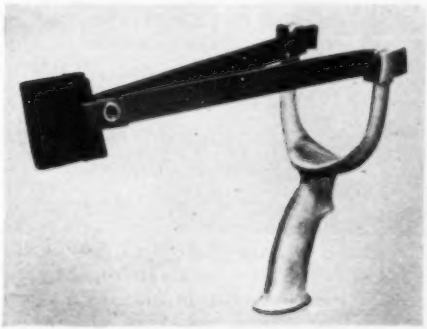


World's Fastest Camera

THE queer-looking pictures above were made with the world's fastest movie camera as it slowed a speeding bullet to an inch-a-minute crawl. The left-hand picture is the negative, made with a lens-and-slit system that dissects the image into horizontal slices and lays them out on the film side by side. Printing back through this same lens-and-slit arrangement reverses the process. The negative produces 2,000 individual movie frames, one of which is at right above. The dark blob is the bullet; the vertical shadow, the target—a sheet of glass.

Developed at the University of Rochester, the shutterless camera (right) makes exposures at the rate of 11 million a second on two feet of 16-mm. film whirling inside a revolving drum. A series of side-by-side lenses gives multiple images. The slit picks up a different slice from each image, crowding the whole picture into an area as wide as the film but only 1/2,500 inch high. Narrowness of the slit acts like a focal-plane shutter and prevents blurring.



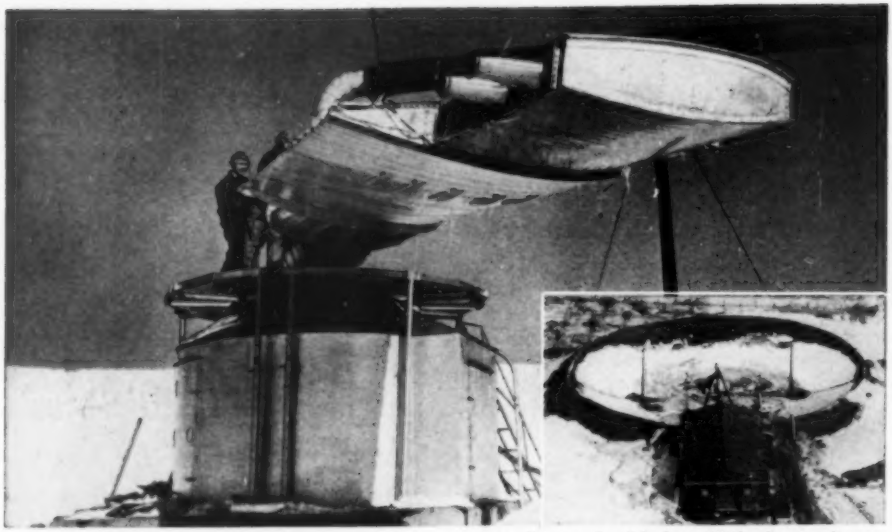


Slingshot Goes Modern

INTERESTED sportsmen can now obtain a streamlined, precision version of that ancient weapon and toy, the slingshot. Called the Catapull®, it has a light, aluminum frame, with a pistol grip, and heavy, live-rubber slings. The R.W. Hodge Co. makes it.

Makes More X Rays

MODERN styling and increased efficiency are combined in this new GE X-ray therapy machine. For use in the treatment of skin diseases, the compact, streamlined, pearl-colored unit more than triples the radiation per minute provided by earlier models.

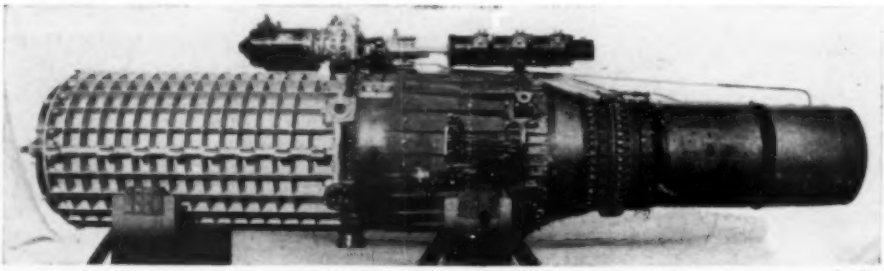


Egg-Beaters Try Jet

JET propulsion for helicopters is getting a trial run in the bowl-shaped, outdoor test pit shown in the inset above, a part of GE's Schenectady, N. Y., Flight Test Center. With developmental jet units at its tip, a helicopter blade is whirled around a turret pivot located in the center of the pit.

For drag studies, when the blade-tip jet units are not operating, a 1,000-hp. electric motor drives the blade. With the jet burners operating under their own power, the spinning blade converts the motor to a generator, whose output measures thrust.

The large steel building adjoining the pit contains laboratory facilities, a workshop, and controls for operating the outdoor propelling mechanism. An observation room has three-foot-thick concrete walls to protect engineers during runs of the rapidly whirling jet helicopter blade.



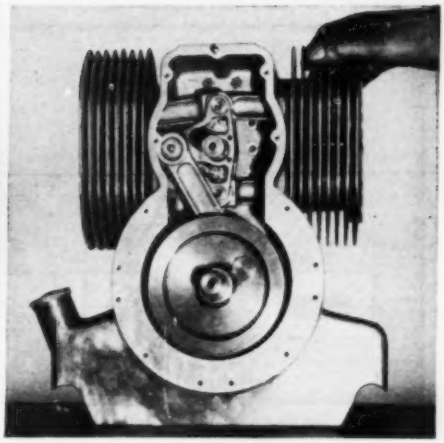
More Power, Less Fuel

THIS radical turbojet may lick the bugaboo of jet aircraft—high fuel consumption that limits their range. Thermal efficiency of the new XJ-37 is reported so great that it will enable fast jet bombers and fighters to fly as far as current reciprocating-engine types. Present jets have less than one-fourth the range of their slower rivals.

Designed by Lockheed, the XJ-37 packs the 8,000 hp. of a Diesel railroad engine into a package weighing less than one of the locomotive's drive wheels. Its small frontal area permits the jet to fit into either wings or fuselage with a minimum of drag of nacelles or intake ducts. It can be used either as a pure jet engine or in a turbine-propeller combination.

To speed completion, final development and testing of the engine is being carried out at the new turbine-research laboratory of the Wright Aeronautical Corp., Wood-Ridge, N. J. (PS, Jan. '48, p. 142).

To demonstrate its easy riding qualities, the Wooler was driven up and down a 6" curb at 15 m.p.h. The spring frame of the machine absorbed most shocks. Steering remained steady.



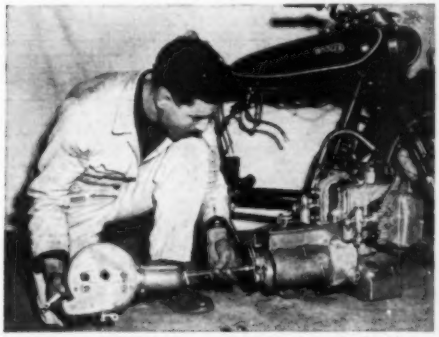
The master connecting rod moves in an arc at its smaller end. This causes the rocker beam to rock around its central pivot. Four smaller con rods are linked to the ends of the beam.

British Cycle Has Rocker-Beam Engine

THE rocking-beam principle, familiar in old steamboats, is applied in the four-cylinder engine of the Wooler, a British motorcycle. In the photo at upper right, four connecting rods may be seen attached to the top and bottom ends of the triangular rocking beam, while the small end of the master connecting rod joins at an extension to the left of the beam pivot. As the rods move the beam, they deviate only slightly from a horizontal path.

For its 5-hp., 30.50 cu. in. engine, this motorcycle is comparatively light at 230 pounds. The oil tank is integral with the crankcase, so that the entire oil supply assists in crankcase cooling. In the photo at right above, the oil tank filler is at the lower left. Ignition and lighting are by a 46-watt, 12-volt generator, with a 2-volt battery for parking lights.

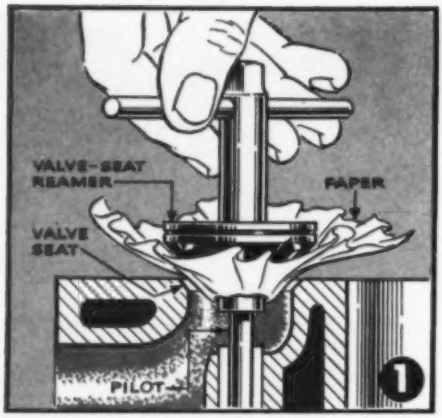
Designed for simplicity of servicing, the cycle may be taken apart by the use of only two wrenches, no screwdriver being necessary. The engine and transmission, together with the shaft drive and the rear wheel, can be removed from the frame in six minutes.



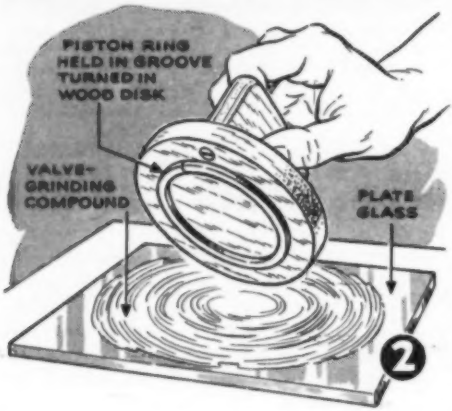
Entire power train is easily dismantled. Here engine, gear box, and shaft drive are removed.

Faired into the gas tank, both headlight and speedometer differ from conventional design.

Hints From the



1. Stopping Chatter. If you have to ream a valve seat by hand, here's a trick that has been useful in the Model Garage. Slip a piece of thin paper over the pilot and ream right through it with short, quick turns. This will prevent the vertical ridges or chatter marks that sometimes ruin jobs of this kind.

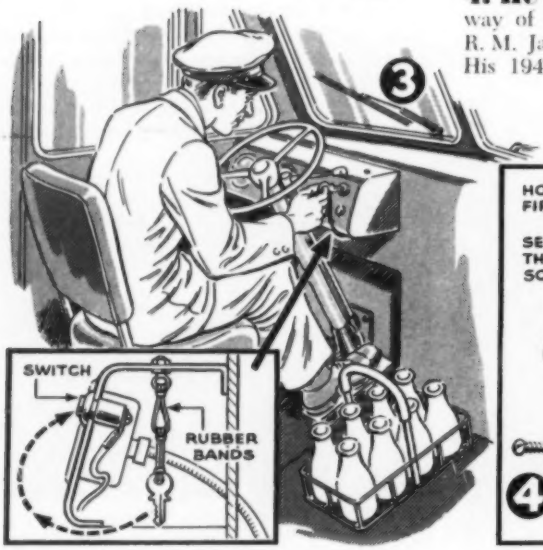


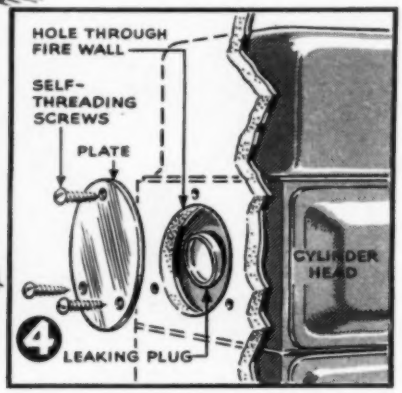
2. Ring Sized in Jig. Piston rings that are oversize in width can be ground with this jig. Saw out the disk and turn a groove in which the compressed ring will partially fit.

3. Ignition Key Hidden. A milkman must often go out of sight of his truck while making deliveries. Rather than invite theft, one driver pocketed his ignition key each time that he left. But it was always a nuisance to fish around for the key when he returned. He has now solved the problem by fastening the key behind the instrument panel with a rubber band. This keeps it hidden, but always at hand.

4. He Kept His Head On. An easy way of doing a tough job was found by R. M. Jackson, Jr., of Patuxent River, Md. His 1941 Buick developed a leak in the

Drawings by Stewart Rouse





Model Garage

freeze-out plug at the back of the head. The repair job threatened to be long and costly, because the closeness of the fire wall seemingly meant that the head had to be removed. Instead, he cut a hole in the fire wall and had the job done in minutes. A plate closed the hole.

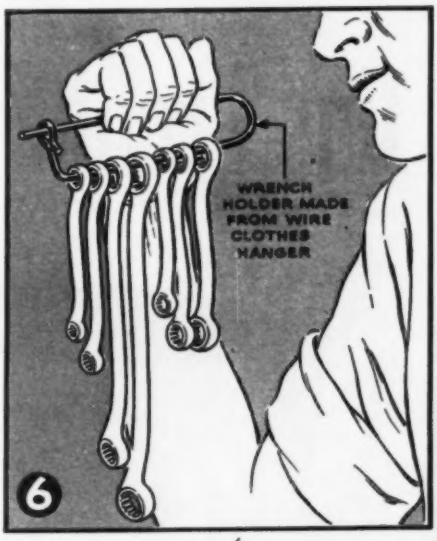
5. Getting Back Lost Plates. Erich Dallmer, of Narrowsburg, N. Y., suggests painting your name and address on the back of each license plate. It's a fine idea, and costs less than a replacement.

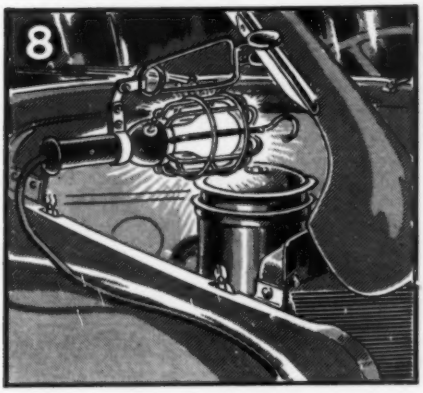
6. Wrenches Kept Together. Tired of hunting through his tool case for a needed box wrench, Arthur E. Nordhoff, of Seattle, made a large "safety pin" from a clothes hanger. This keeps them all at hand.

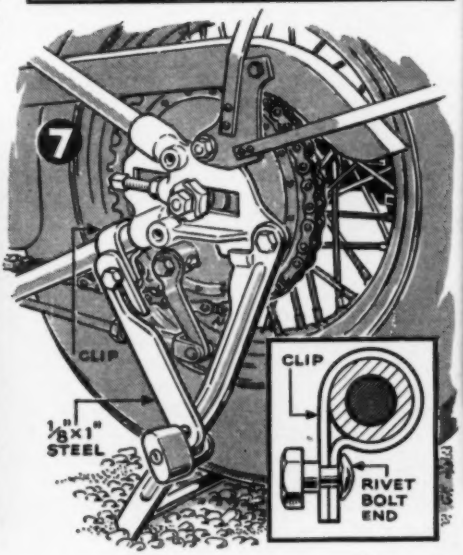
7. Lock Protects Motorcyle. This rig, writes Ivan J. Stretten, of Detroit, will both lock a motorcycle and prevent it from rolling off the stand. The slot in the arm lets you stow the arm in the tool box when it's not in use.

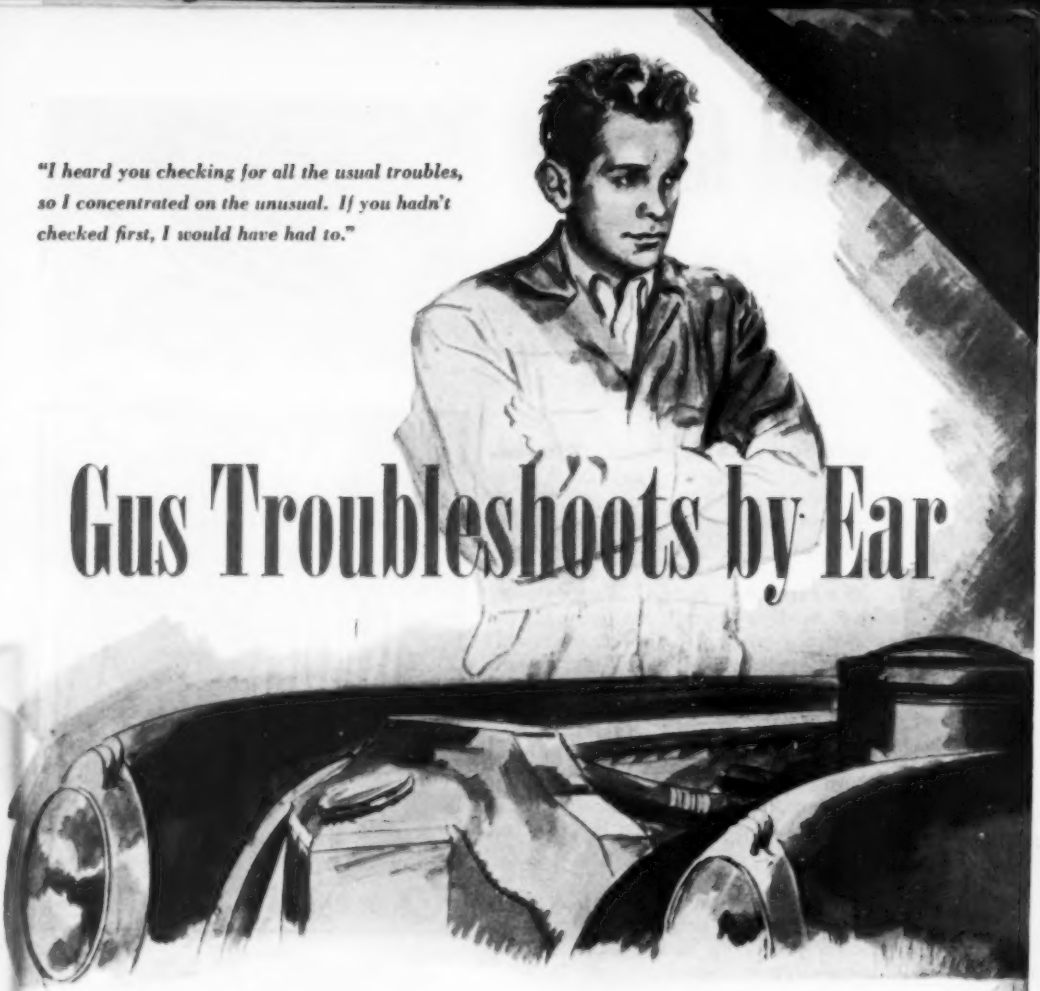
8. Clamp Added to Light. A spring clamp of the kind used on photographic lights lets you clip a trouble-shooting lamp in practically any desired position. H. Zave, of Chicago, makes the suggestion.

Gus Wilson









"I heard you checking for all the usual troubles, so I concentrated on the unusual. If you hadn't checked first, I would have had to."

Gus Troubleshoots by Ear

By Martin Bunn

"AFTER all," Joe Clark insisted, "this Model Garage is a business. We ought to conduct it like one!"

Gus Wilson grinned at his go-getter partner. "We're not running it exactly like a church bazaar," he commented. "I thought we weren't doing so badly."

Joe's sharp eyes gleamed behind his horn-rimmed specs. "We're not doing so badly," he snapped, "but we could be doing a lot better. We've invested in first-class equipment that enables us to do almost any job and keeps our costs in line. But you're forever turning down jobs because we can't get them done in time. Inefficient! That's what it is!"

"You sound like an after-dinner speech at the Junior Chamber of Commerce," Gus scoffed. "All right—what'll you have?"

Joe pointed out the office window at Stan Hicks, who was hosing down the driveway. "You've developed that kid into a good mechanic. You told me so when we gave him a raise, but you're still wasting his time on grease-monkey jobs."

Gus felt relieved. Joe wasn't trying to palm off a new mechanic on him. "Promote Stan to a regular mechanic's job and get a new grease monkey—that your idea?"

"That's my idea."

"Well," Gus said, "let me think it over."

He went back to the job he had left on his bench. After a while he heard Stan come into the shop. "Looking for something to do, kid? You might start—" Glancing up, he saw that his helper's face was

ROY QUIGLEY

flushed a fiery red. "What's the matter with you?" Gus demanded.

"I–I–I ain't asked you a question for two weeks!" Stan blurted.

Gus laughed. "Swell. Keep it up!"

"Lookit, boss–what I mean is I don't have to ask questions any more–not so many, anyway."

"I get it. You know all the answers."

"Aw, boss–you know I don't mean that," Stan protested in an outraged voice. "What I mean is, you oughtn't to make me go on doin' boy's work. It ain't only that I ought to be earning the raise you gave me," Stan stumbled on. "It's the–the–"

"It's the principle of the thing!" Gus finished for him, with a grin. He gave Stan a resounding smack on the shoulder. "Maybe you're right–I'll talk to Joe about it." He cut short Stan's delighted thanks by jerking a thumb toward the shop door. "Better open up–someone wants in."

THE limousine that rolled slowly into the shop was big, somberly plutocratic, and obviously new. A chauffeur slid from behind the wheel and held open the door. Out stepped a fat man attired in a Prince Albert, striped pants, and a broad-brimmed fawn-colored felt hat.

"Morning, Senator," Gus greeted him.

Senator Bombey grunted, fished a large cigar out of his pocket, and extended it to Gus.

"Thanks–never use 'em," Gus declined.

The Senator looked Stan over. "Vote yet, boy?" he asked.

Stan blushed scarlet. "No–no, sir," he stammered. "Not until next year."

It's *this* year that Senator Bombey has to run for another term. He grunted again and thriftily returned the cigar to his pocket. Then he jerked his chins toward his car. "Who invented 'em?" he demanded.

"Automobiles?" Gus said. "Some people give the credit to Duryea, and some give it to Selden."

"Credit!" the Senator snorted. "Undependable things! This car has been driven only–how far, Jackson?"

"Fifteen hunnert'n six miles, suh."

". . . has been driven only one thousand five hundred and six miles," resumed the Senator, who never makes a statement in four words if he can make it in a dozen, "and it has a knock. Listen."

Gus listened. From somewhere under the limousine's sleek hood came a half muffled, rapid click. "Speed her up," he directed. Jackson did. The click, still regular, became more rapid.

"Engine's knocking, all right," he said. "If you want to leave your car, I'll–"

"Time," the Senator pronounced, "is of the essence. I must drive to the National Capital today. Vital legislation is impending. My chauffeur will return for my car at two o'clock. I trust that you will make every effort to have it in first-class condition at that time." He held out a fat hand to Gus. "Good-by, Mr. Wilson. Remember, when you go to your voting place to exercise the free American citizen's proudest privilege, that 'Bombey Serves the People!' . . . Jackson, get me a cab."

He went out. "Windbag," Gus laughed.

But Stan was impressed. He stared at the limousine, feeling that he was playing a part in important events. Senator Bombey had to get to Washington, and he would help him do it, and at the same time prove to Gus that he had what it takes when the chips are down.

"Want me to take care of this job?" he asked with faked carelessness.

"Sure–go ahead," Gus told him placidly.

FOR a full five minutes Stan, his youthful and grease-smeared face reflecting intense mental effort, regarded the Senator's car. Gus didn't have to watch Stan to know how he was going about the job of trouble-shooting–his trained and experienced ears told him. He nodded approval when he saw Stan checking the valves with a feeler gauge–a worn valve stem guide or too much tappet clearance causes most clicking noises in auto engines. But this time the valves didn't seem to be at fault, for Gus heard Stan get a sounding rod and start using it in an effort to locate the noise. "The kid's showing good sense," he thought. "That click *could* be caused by a broken piston ring, or maybe a loose piston or a bad crankshaft bearing–but I don't think it is."

Apparently it wasn't, because for the next hour he listened to Stan trying one thing after another. He grinned broadly when he heard a tool being slammed down. Gus knew that licked feeling!

"Guess I'll get my lunch," Stan said.

"Okay, kid."

When he was sure that Stan was out of the shop, Gus started the engine of Bombey's car and listened intently. The muffled, regular click speeded up–became almost a

steady noise—as he pulled out the hand throttle.

Gus scratched his head reflectively. Then he throttled back to idling speed, picked up a sounding rod, and, with his ear close to its upper end applied it to various parts of the engine. "Sounds like the crankshaft," he muttered after a couple of minutes, "but it couldn't—now, I wonder!"

Almost as the thought crossed his mind, he reached in and retracted the oil dipstick about an inch. Instantly the clicking stopped. With a broad grin on his face, Gus switched off the ignition, removed the oil stick, wiped it clean, and examined it carefully. "It would be a dirty trick," he mused with a chuckle, "but I'd like to see what he does . . ."

Laughing, he made his way to the back of the shop and scanned the old engines lying about there. Two were of the same make as Senator Bombey's limousine. Gus quickly pulled the dipstick out of the newer of the two relics and compared it with the one he held in his hand. Close examination showed that in this respect, at least, the engines hadn't changed. Wiping it clean, he carried the rod back and inserted it in the limousine. Then he started the engine. It purred almost noiselessly, and without any click.

Gus laughed again and went down to the Park House for his lunch.

WHEN he got back, Stan promptly announced: "The Senator's bus is ready."

"Good!" Gus said. "So you got rid of the knock. What was causing it?"

"I couldn't find out, boss," Stan admitted unwillingly but honestly, "but it ain't there anymore."

"That's queer," Gus said. "I'll take a look—say, will you get me another screw like this from the stockroom?"

As the door closed behind his helper, Gus hurried over to Bombey's car, took out the dipstick, and replaced it with the original. When Stan came back he was busy at his bench.

"Thanks," Gus said. "Now I'll check that engine."

He started it. Stan's eyes popped and his jaw sagged. The half-muffled click was there again.

"Didn't you say you'd got rid of it?" asked Gus reproachfully.

"It wasn't there when I came back from lunch—honest it wasn't!" Stan wailed. "I ought to have asked you to help me, boss. I'm a heck of a mechanic!"

Gus gave him a poke in the ribs. "That's so," he said, "but you're the only mechanic we've got."

Amazement spread on Stan's face. "What do you—? I mean—that is, I am a mechanic, kind of, only—"

"You're promoted."

"But, boss!" Stan pointed at the Senator's car. "After what I did—?"

"Oh," said Gus soothingly, "you didn't do too badly. That's just one of those things that can happen to anyone around here." Gus chuckled and poked his assistant on the shoulder. "You did everything except fix the bus, and there's no need to cut your throat over that."

"Maybe not, but what are we going to do about it?"

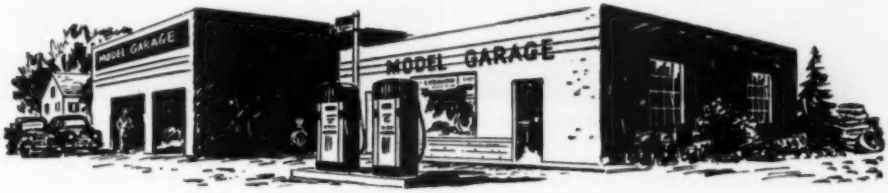
"Fix it, quick," Gus told him. He stopped the engine, pulled out the original oil stick, and replaced it with its duplicate. "Try her now."

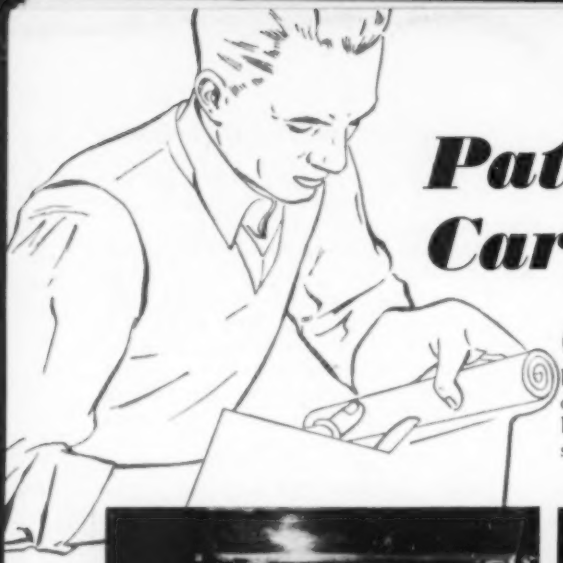
Stan did. The knock was gone. "I don't get it, boss," he said helplessly.

Gus handed him the dipstick. "Somebody bent this just a bit—stepped on it, maybe. Anyhow, the crankshaft hit it every turn."

Stan took the gadget, shaking his head. "I knock myself out making every test I can think of, and then you come and find the trouble right off."

"Sure," Gus laughed, "*because* you made the tests. I knew you'd looked for all the usual troubles, so I concentrated on the unusual. If you hadn't checked it, I would have had to. You wouldn't go looking for a needle in a haystack unless you've looked in the sewing box first!" END





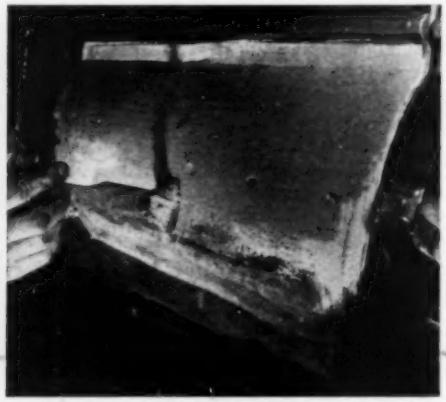
Patch Up Your Car with Cloth

COTTON cloth impregnated with plastic offers an easy way to cover rusted or broken-metal areas in the fenders and body of your car. Already being used by a number of repair shops, the procedure is so simple that any handy man can do a good

1. Here's the problem. Rust has eaten away the metal to such an extent that it breaks or you may poke a finger through it. This looks like a shop job—but you can do it yourself.

2. Scrape and sand off all the paint around the rust and clean down to the live metal. If the metal were broken or torn in a collision, you would start the repair job the same way.

5. Successive layers of Celastic Ⓣ may be used to build up spots where the original metal is completely gone. Allow each layer to set 15 to 30 minutes before applying the next one.



6. Brush metallic-base putty over the patch after feathering back the edges about 1½" with sandpaper or a power sander. Cut the putty to a thin paste. Allow it to dry several minutes.

patching job at home. It also has the advantage of being inexpensive.

In the form that you buy it, the material looks and feels much like any closely woven fabric. You can roll it, crumple it, and cut it with a pair of scissors. But dipped into a solvent, the plastic-treated fabric becomes extremely rigid as it dries and will hold the form into which you mold it.

Three bonded layers of the material are said to have a tensile strength equal to the sheet metal on an ordinary car. It does not rot, rust, or mildew, and it's not affected by severe climatic conditions. When dipped into an acetone-base solvent, the plastic-impregnated material bonds itself to any surface that does not have a highly glazed finish. After it has set, you can coat it with a metallic-base putty, sand it down to a smooth surface, and apply paint or enamel.

Called Celastic Ⓣ, the material was developed several years ago by **The Celastic Corporation**. During the war it was employed as an outer stiffener for self-sealing airplane fuel tanks. Since then, its characteristic of setting into a rigid form has brought it into use in a number of fields.

A. P. Deckert, of Buffalo, N. Y., distributes Celastic for use in the automotive trade. In addition to supplying repair shops, he

3. Cut a patch, allowing at least a 2″ overlap, dip in solvent—but not longer than five seconds—and then whirl it in the air for a few seconds until the coating becomes tacky.

4. In applying, press the patch down firmly and mold to the original contour of the metal being replaced. Be careful to avoid pressure where there's no backing. Let it dry an hour.

7. Sand the putty to a smooth finish with a fairly fine paper (preferably No. 280). If the surface is still not as smooth as you'd like, apply a second putty coat and again sand it down.

8. Apply paint—and the job's done, this one in a matter of only two hours. If you work carefully, the area will look almost like new. The cost? Well, it's surprisingly low.

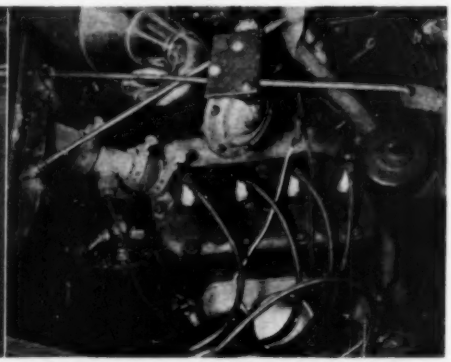
is considered inexpensive kits for home use which include three thicknesses of the material, a can of solvent, some metal putty and reducer, sandpaper, and directions for carrying out the job. The three weights of the material are: heavy, about 1/16" thick; medium, 1/32", and thin, 1/64".

Body shops already have found Celastic both a time and money saver. For example, the job illustrated here took only two hours from start to finish, including a one-hour setting period for the patches, and the materials that were employed cost in the neighborhood of $1.50. Tests have shown that a patched area is practically as durable as a welded repair.

One automotive shop that has been using Celastic for body repairs also has found that it can be used to strengthen the sheet aluminum cabs supplied for Jeeps Ⓣ. Applied inside the cab, the material makes the aluminum much stiffer. END

As a stiffener, the fabric may be used in many ways. At the Crystal Collision Co., Brooklyn, it's applied inside aluminum cabs on Jeeps Ⓣ.

Everyone in the family can squeeze into the single seat. Notice the Nash grille at the front.



A souped-up Austin engine delivers 25 hp., and gives about 35 miles to a gallon of gasoline.

Homemade Midget Car Carries Three Persons

PARTS from a lot of different cars went into a midget auto that Harry B. Johnson, of Los Angeles, built in his spare time. Only 33" high, it's wide enough to seat three persons with ease.

Both the chassis and engine are of American Austin manufacture. Frame and springs were lowered and midget racing-car tires installed. Plymouth instruments find service in the cockpit, Ford bumpers were cut down to suit, and a Nash grille was used. Fenders and body panels came from an Austin and Pontiac. False stacks decorate the hood.

The steering wheel is a plane-control wheel. Windshields were formed from clear plastic.

Mechanics and Handicraft

Handy Man's "Workhorse" PAGE 159

Furniture from the Forest PAGE 172

Beveling and Chamfering PAGE 178

How to Buy Radio Parts PAGE 196

Mining Silver in the Darkroom PAGE 206

An armful of tools and a workbench —take them to the job in one hand with the PS "Workhorse." Page 159

Action Station for Small Fry

A combination play desk and dinette Dad can build will keep Junior busy from age one to six.

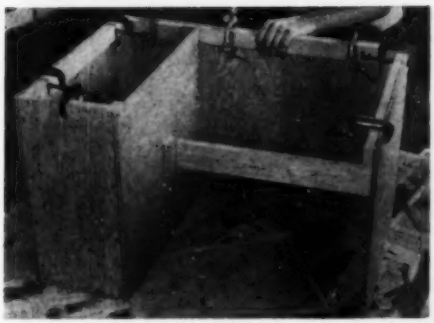
By Roland Cuera

SOME furniture for a youngster's room is bought or built to please the child, and some to please his mother. It isn't often that both generations are satisfied with the same piece. So many of the units that are safe, sturdy, and easy to keep clean seem to rate like spinach with the young ones—healthy but unpopular.

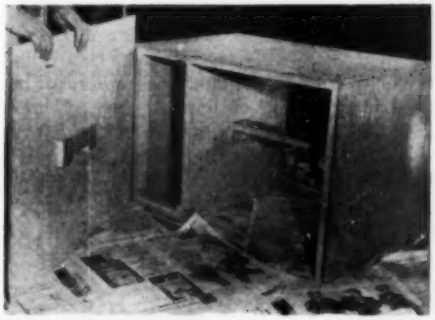
We've had our troubles with Buster's equipment. More than once I invested money, muscle, or both in stuff that just hasn't held his interest for more than a day or two, so I was pretty glad when I hit on this idea. He likes his new game and feeding center, and so do we. The top is so rugged that he can bang away at it to his heart's content, and large enough to accommodate a full-course dinner. Hinged side panels make it a little bit harder for him to sweep his hamburgers onto the floor.

The cantilever chair is adjustable back and forth. It has arms that raise up when you put baby into the seat, then lock down in safety position so that he can't fall out. Below is a foot rest that can be adjusted for both height and tilt. Chair assembly and foot rest are both held in place by bolts and wing nuts that can be removed in a minute. When he gets too old for the seat—which will probably be around three—the whole business can be removed and a conventional child's chair substituted. He can then use the desk section, with its drawer and toy compartment, until he's six or seven—unless it happens to be needed sooner for his kid sister.

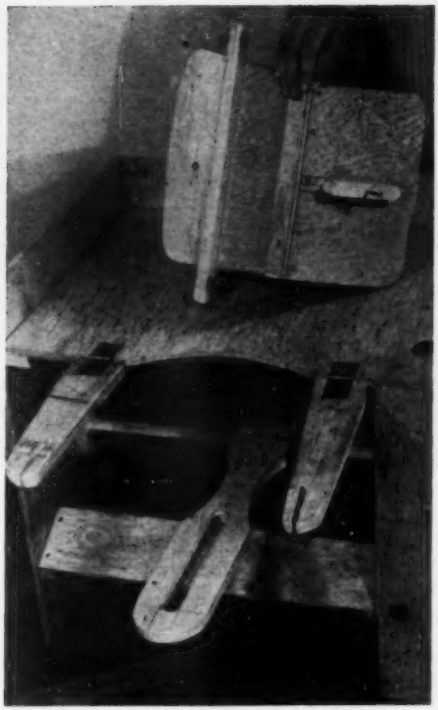
Recommended material is ¾" plywood for most of the larger pieces (one 4′ by 8′ panel is plenty). Pine or similar wood may be used for all the heavier structural members except the seat board. Springy, well-seasoned hardwood will be needed to withstand the jolts that this piece will have to take.



Clamps hold the plywood to the frame while it is fastened with screws driven from outside.



Locate the seat-board socket carefully on the back before you fasten this piece in place.



The cleat on the seat bottom fits the slot in the seat board, permitting forward adjustment.

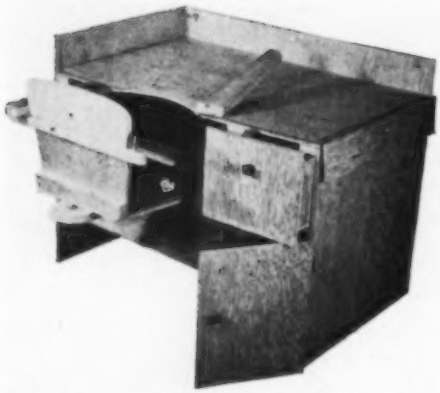
Start by laying out the sides, back, top, partition, hinged side panels, drawer parts, toy-cupboard door, cupboard bottom, seat, and foot rest according to the dimensions given in the drawing. A good way is to cut the individual outlines out of wrapping paper, arrange them on the panel for least waste, tape fast, and draw around them with a straightedge. Cut the pieces out with a sharp 10-point crosscut saw. If you must use a rip or coarse-toothed saw on the plywood, leave a little margin so that you can file off the roughness that results.

Clamp the framing strips to the sides, partition, and cupboard bottom and screw them in place as shown in the upper left-hand photo above. The screws are driven through the plywood and into the framing. Fasten the top to the sides, and add the partition and bottom. Screw the seat-board socket to the back and put the back in place.

With the desk upright, attach the drawer rails with glue and brads. Hinge the wings and the cupboard door in place. All drawer joints are butted and fastened with brads and casein glue. This construction is strong enough if all the edges are truly squared. Rabbeted, dadoed, or dovetailed joints are harder to make but produce a more professional appearance. If you decide on any of these alternate methods you will have to change the dimensions accordingly.

The top of the chair back is a piece of pine measuring ¾″ by 3¾″ by 11″; it is rabbeted to receive the plywood back. A 1″ by 1″ by 15¾″ rail fastened behind and just below this top piece extends out at both sides to support the ends of the arms. The lower portion of the back is reinforced by a ¾″ by 1¾″ by 9½″ cleat to which the seat bottom is screwed. Plane a slight bevel on this piece before attaching the seat bottom so that the back will slant a couple of degrees off the upright position (a comfortable seat is an important item in the rearing of your child).

Another cleat ¾″ by ¾″ by 4″ is screwed to the bottom of the seat. Drill a hole through it and the seat for a countersunk flathead bolt. The cleat rests in the slot in the seat



Completely assembled, the play desk is ready for sandpaper, paint, decoration, and the baby.

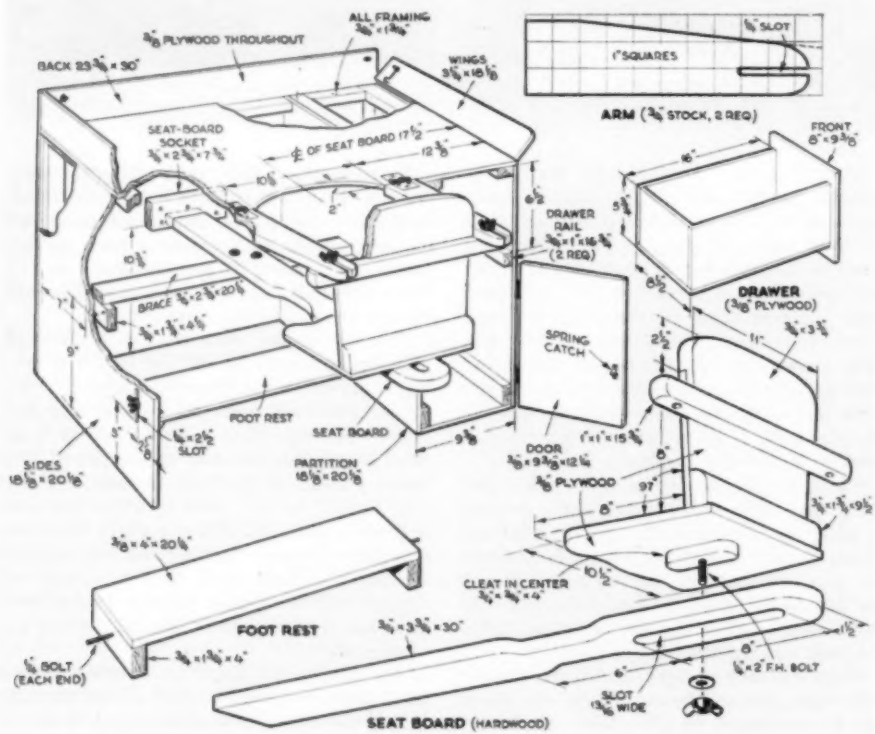
board and is adjustable simply by loosening the wing nut on the bolt.

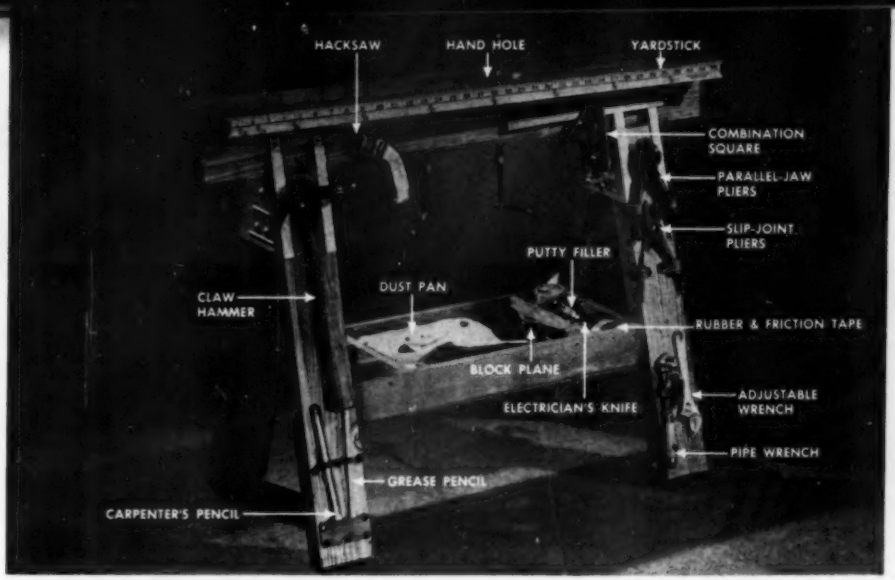
The seat board itself is made of ¾" by 3¾" oak, hickory, or other springy hardwood. Cut the arms from ¾" stock and hinge them to the desk top. Slots in the ends allow play across the hold-down bolts for seat adjustment and also for bounce when the child is in the seat.

Install the seat board with two stove bolts through the brace. No fastening is necessary at the end since this fits into the socket.

Stove bolts are driven through the centers of the two cleats to which the foot rest is fastened. The bolts project through slots in the left side and partition. Wing nuts and washers—one outside the left end, the other inside the cupboard—hold the foot rest at the desired height and angle.

Sand all parts—especially the plywood edges—and apply a coat of flat white paint. Follow this with one or two coats of enamel of any desired color. Attractive decals, nursery-book cutouts, or hand decoration can be used to finish the design. A piece of linoleum on the top will make it a cinch to keep this hard-working desk as clean as nursery furniture should be. END

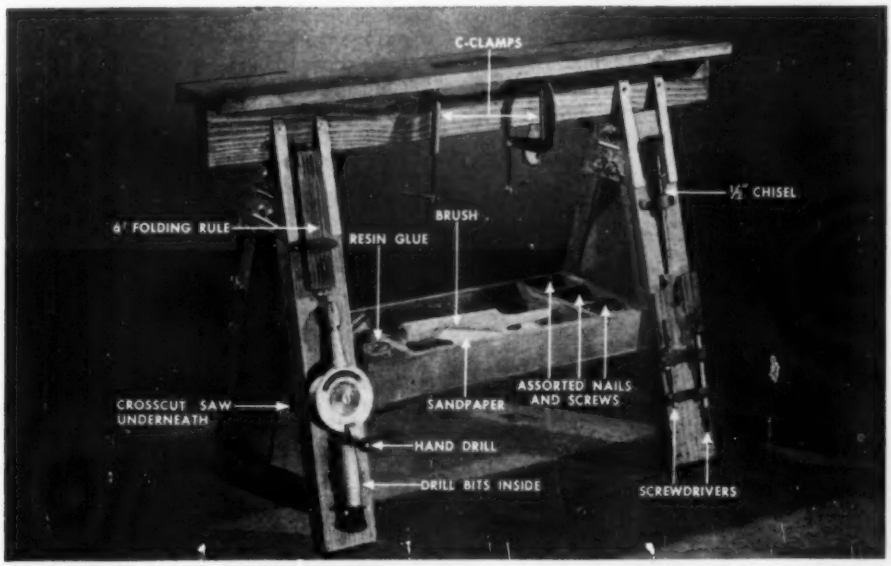




"Workhorse" Carries Your Tools

Popular Science Practical Solution

A NATURAL for the handy man of the house, the PS "Workhorse" takes the bench to the job. The Editor designed it for his own use to save those extra trips to get forgotten tools. It provides a working surface for routine fix-it chores—and it even has a brush and dustpan for cleaning up afterwards. Start out by making yourself a sturdy sawhorse, add a plank top and a compartmented shelf, and fit it with the tools that you use most often for odd jobs. Strips from an old belt make fine tool-holding loops.



Take your pick of three designs. At left is one with a glass top. Plans for center one, which has frosted glass panels, appear below. Wrought-iron scrolls support the one at right.

Post Lamps to Mark Your Drive

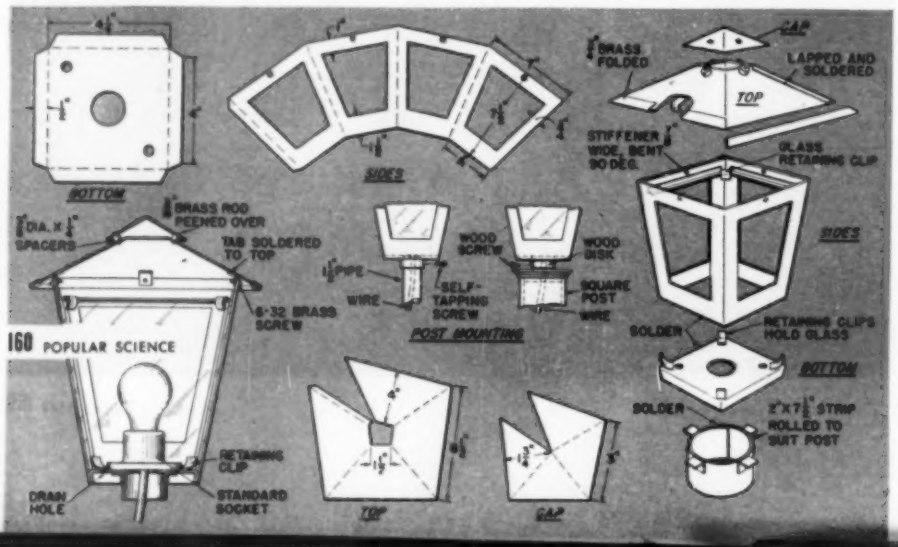
ENTRANCES and driveways gain an air of pleasant dignity with these post lamps, borrowed from the past but modernized with electricity. They aren't hard to make of 1/32" sheet copper, calling only for a little care in laying out and soldering.

The construction below can be adapted to various lamps. Make the bottom first, drilling drain holes outside the mounting collar and cutting the center for a porcelain socket. Solder retaining clips at each corner.

The sides are cut as one piece. Lay out a cardboard template in the form of a truncated triangle 7" on the base line, 7½" high, and 4" wide at the top. Draw the glass opening inside. Scribe around it on the copper; then lay it along the scribed outline and trace again, continuing until you have a four-sided pattern. Cut the windows with a chisel while resting the metal on a wood surface.

A top and cap also are each cut as a single piece. Lay out both with templates (the cap template is a 3" triangle). Solder tabs under each edge of the top and drill and tap for 6-32 brass screws ¼" long. This makes the top removable. Strips of brass bent into a U-shape, slipped over each edge, and soldered give a more finished appearance. The cap is riveted on, with spacers between.

For mounting on a pipe post, roll a collar to suit, solder to the bottom of the lamp, slip the collar over the post, and turn in a self-tapping screw.—*Hi Sibley, Nuevo, Calif.*

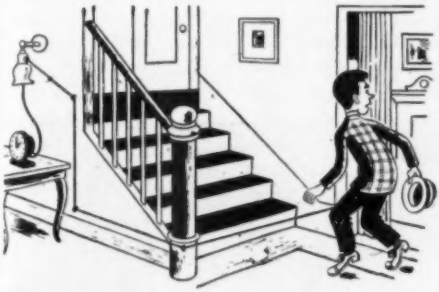


What's Your Ingenuity Quotient?

Happy though married, it nevertheless riled me to have to hold skeins of wool for my wife just when I wanted to read my paper. One night, seeking a way to escape the chore, I loosened the finial on a lamp and laid the skein around the shade. My spouse wound the yarn while the shade spun merrily.—*A. B. Iannone, Lyons, N. J.*

You can't pull the wool over baby's head when a washed bonnet dries all out of shape and shrunken to the size of a head-hunter's trophy. Baby himself supplied me with the answer to that one. Now I blow up rubber balloons to the size of his head. Woolen caps and bonnets are pulled over the balloons while still wet. They dry to size.—*Mrs. Bob Smith, Venice, Calif.*

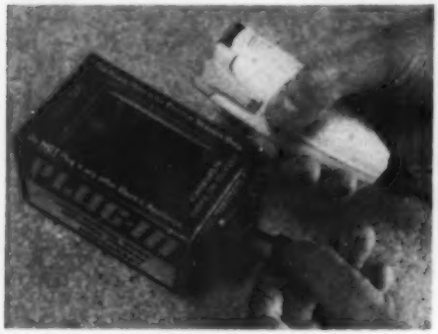
I was in a jam when film jammed in my camera just as I was discovering the Grand Canyon. To open it meant I'd lose pictures taken, yet I didn't want to stop shooting. Zipping up a leather jacket, I laid it face down with the camera inside. Neck and waist were folded and weighted down. With my arms in the sleeves, the job was done.—*A. P. Jeanneret, Roselle, N. J.*



My son, an owl, was always coming in very late at night, and then swearing on a stack of pancakes the next morning that he hadn't. So I fastened a black thread to the wall, led it across the stairway, and tied the free end to a switch supplying current to an electric clock. No matter how silently he pussyfooted in, the stopped clock would show the time of his return.—*H. C. Boyd, Dearborn, Mich.*

Have you pulled off a smart one lately? We will pay for acceptable contributions showing ingenious solutions of problems in the home, shop, garage, or camp. It doesn't matter if it's wacky—if it works. Use government postcards only. Contributions cannot be acknowledged or returned.

AIDS TO MODERN LIVING

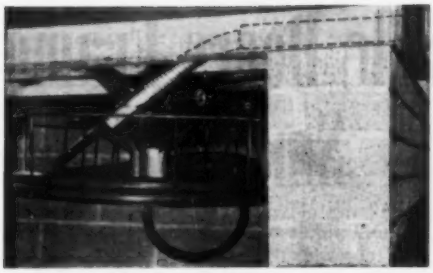


Battery Operates Shaver. A small battery with an output of 115 volts makes it possible to use an electric shaver at camps or on trips where electric power is not available. Measuring 2½" by 2¾" by 4¼", the unit has a built-in mirror on one side. The manufacturer claims that it's good for about 100 average shaves. A product of the Bernard S. Greiff Co., San Francisco, the unit sells for about $3.

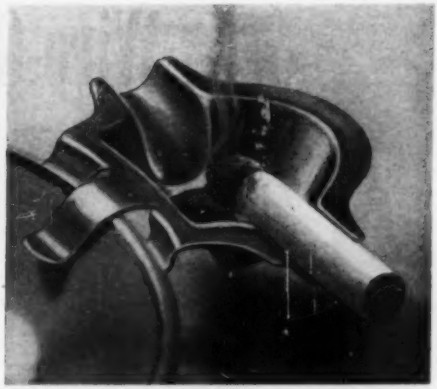
Juicer Top Tilts Out of Way. When you're using a new fruit juicer introduced by the Rival Manufacturing Co., of Kansas City, Mo., a backward turn of the lever both raises the top and tilts it back to allow easier removal and insertion of the fruit. The rack-and-pinion mechanism is geared low to put heavy pressure on the fruit with less effort. A built-in pitcher catches the juice as it's pressed out.

Grapefruit Easily Cut. A new kitchen tool made by the Special Products Co., of Silver Spring, Md., prepares grapefruit halves in a few seconds. It consists of a hollow metal center post encircled by 12 metal blades and an adjustable knife that cuts the fruit away from the rind when the tool is turned. The center cuts out the core.

Toy Dog Has Electric Eyes. The eyes of this toy dog are small electric bulbs that light up when the stuffed body is pressed. The colored bulbs and a battery inside the toy are replaceable when they wear out. Distributed by the Bernard Fine Company, of New York City, the toy sells for approximately $3.

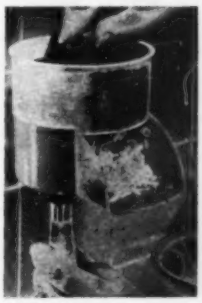


Hose Stored on Cellar Reel. Installed on the cellar ceiling, this garden-hose reel makes the hose easily available, yet stores it out of the sun. Permanently attached to the water line, the hose extends through a casing to an outlet box mounted outside the house. In addition to the nozzle, the box contains an extension rod that operates a shut-off valve in the water line. The hose is returned to the reel by pushing it back through the casing. Zierden Manufacturing Co., of Milwaukee, Wis., makes it.



Tray Clips to Saucer. These little silver-plated ash trays are designed to keep cigarette ashes out of coffee cups or saucers. Clipped to the saucer, they give each smoker an individual ash tray. Alfred H. Glasser, of New York City, offers them in sets of four for $3.50. They're intended for parties.

New Grinder. A plastic kitchen unit made by Trade Winds Specialties, Miami, Fla., combines features of a shredder, slicer, and grater. Interchangeable stainless disks do the cutting when the bottom handle is turned. It's installed on the wall.



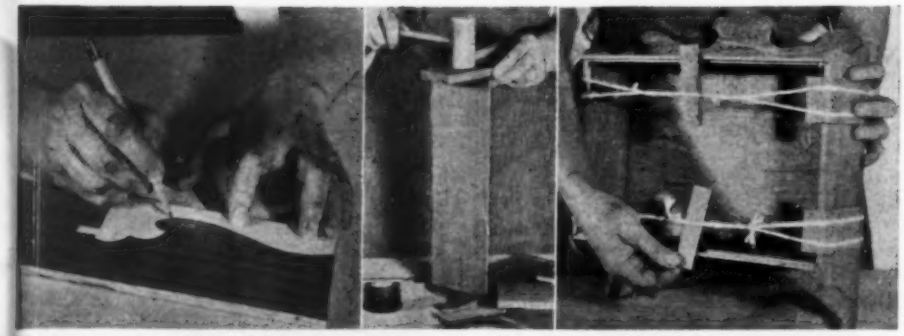
Pipe Has Cleaning Fork. Split metal tubing on the inner end of the stem makes it easier to clean this pipe. A piece of tissue may be inserted in the fork as seen here and then twisted into small size to ream out the shank or mop the bottom of the bowl. A product of Bunnell Pipes, of Stratford, Conn., the pipe sells for about $5.

Cleaner Weighs Only 6½ Lb. A portable tank-type vacuum cleaner just introduced by General Electric may be easily carried slung from the shoulder or held by the strap. Measuring 6" by 6" by 14", it has about 75 percent of the suction of a typical full-size cleaner. It comes with five slip-on attachments, plus a flexible hose.

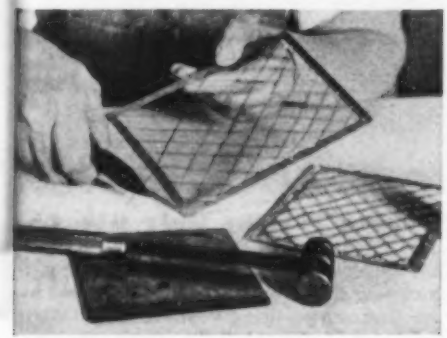
Wire-Grille Doors Frame Small Cabinet

ODD pieces of bric-a-brac, especially the curios that many people enjoy collecting, deserve to be set off in a cabinet of their own. This showpiece will draw attention to them, yet give them the protection that only doors can afford.

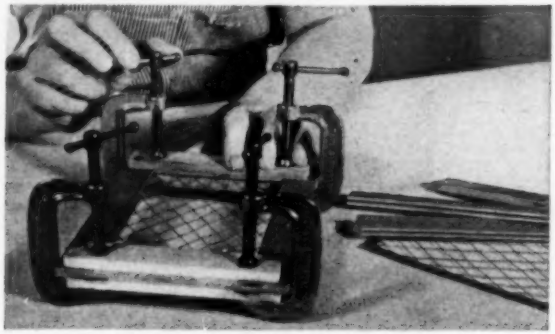
To make the laced-wire grilles used in the doors, cut two frames from any thin sheet metal. In this case 20-gauge iron was used, and the same gauge of brass wire for the grid. Each of the rectangular frames can be cut in a single piece or made up of two L-strips or four individual members soldered



Half-pattern template (left) is taped to top at centerline and flipped over for second half. Center photo shows the bottom shelf being driven into a glued side dado with block and mallet. Tourniquets, right, are used to maintain pressure while the glue sets. Small pieces of cardboard protect the work, while the rectangular back piece holds it square.



The wire grille is woven through holes in the metal frame. Wire ends are laced in and out of adjacent holes, bent over, and hammered down.



Grooves or saw kerfs in the wooden-frame members hold the grille. Projecting parts of the splines are trimmed after the glue has set.

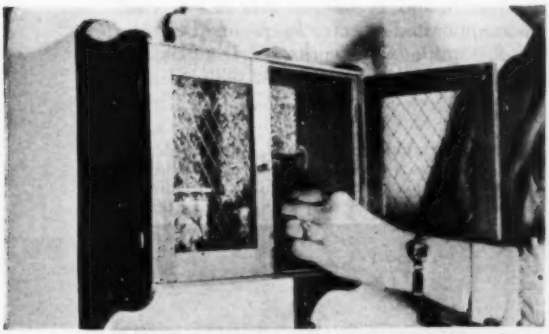
at the corners. The ends of the wire may be soldered to the frame at the points indicated in Fig. 3, or holes can be drilled and the wire woven through with the ends soldered or hammered down. In either case make sure that the lacing is tight.

Each grille is set in a frame made of four pieces of ¼″ wood (Fig. 2). Groove the frame members to provide a snug fit for the grille. A strip of wood is glued to each door to provide thickness for the hinge screws. Hinges are recessed into gains.

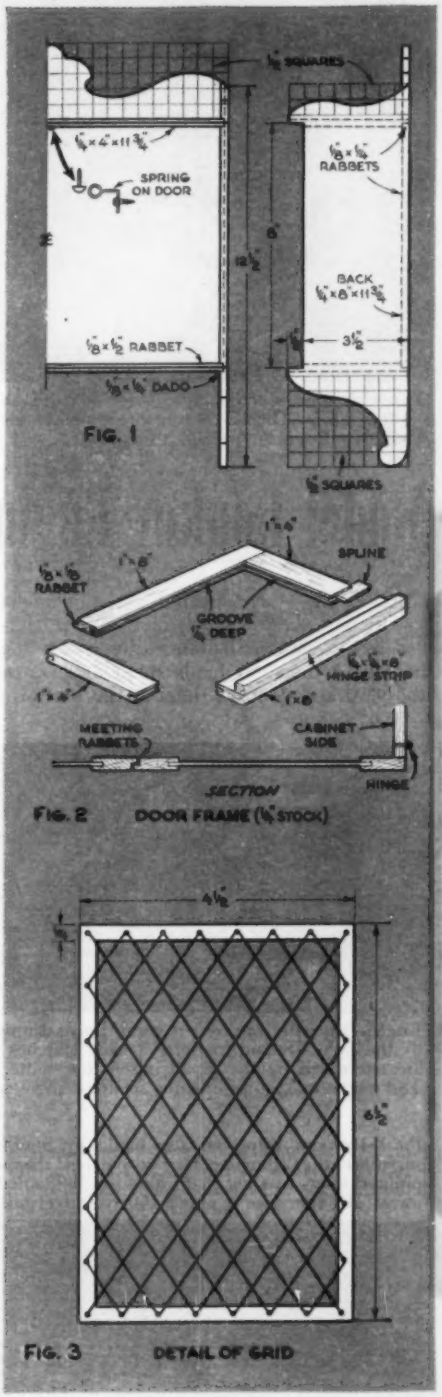
On the pieces to be used for the sides, top, and bottom of the cabinet, make the rabbets and dadoes indicated in Fig. 1. Lay out cardboard templates of the fretted portions to transfer the design for jigsawing. Both sides can be cut in one operation. In assembling the members of the cabinet, use a small glue brush and carefully confine the glue to the dadoes and rabbets.

While hinges and knobs for the doors can be readily purchased, it may be difficult to find a catch that is small enough. You can make your own with an upholsterer's nail and a scrap of spring metal arranged as shown in the inset of Fig. 1. The spring should engage the nail head when the door is closed.

The finish to be applied will depend largely on the kind of wood you use. Mahogany was employed for all parts of this unit except the back. This is cheap plywood covered with small-figured, colorful wallpaper. The mahogany was sanded with fine paper and given two coats of diluted shellac. When dry, each coat was lightly steel-wooled. For the final finish, polishing wax was rubbed with a woolen cloth.—*Bertram Brownold, Cedarhurst, N. Y.*



The finished cabinet displays knickknacks to good advantage. A piece of colorful wallpaper is glued over the inside of the wooden back.



Three drums take the lines, made of airplane control cables. The sky line is in the rear; middle is haul-back line; front is main line.

Two small logs swing down from the high line as Smith lightly fingers the throttle levers and brake pedals. Note the intricate rigging.

Model Donkey Engine Handles Real Logs

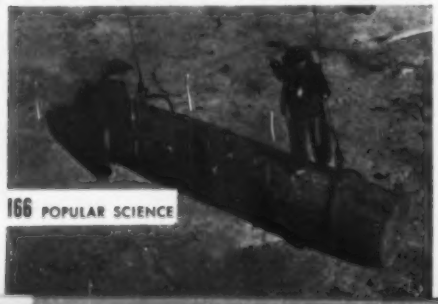
THIS back-yard steam-driven donkey, a rig known to loggers of northwest forests as a slack line, handles timbers just like its big brothers. It hauls small logs across the yard and deposits them at the foot of a spar tree, ready to be hauled away in trucks.

Built by a former high climber, Robin J. Smith, the donkey operates alongside his workshop at Long Beach, Calif. It weighs 350 lb., is skid-mounted, and is an accurate model at a scale of 1½″ to 1′. Engines, throttles, "steam frictions" (power-operated drum clutches), and drums all work like those on real slack-line donkeys.

The double-acting steam engines, built chiefly of cast iron, have a 1½″ bore and 1¾″ stroke. Each piston has two cast-iron rings. Valves are piston type, and roller bearings are used throughout. The boiler, 10″ in diameter and 24″ high, has 120 copper tubes. Fired by gas from city mains, it will develop 120 lb. in 30 minutes from a cold start and is safe at 200 lb. A small steam-operated injector keeps up the water level. Smith, who works for Douglas Aircraft, values the model at $2,000.

Engine throttles are by left hand, brake drums by the right. "Steam frictions" (drum clutches) are controlled by the piped box in the center. The model makes use of three separate engines.

Paul Bunyan puppets, also made by Smith, supervise the attachment of a pair of sharp-pointed tongs to a log that's about to be hauled away. His spar tree is about 150 scale feet tall.



Lines are rigged just as real loggers do. The high lead block (left) and the carriage block are aluminum castings that Smith made himself. A real high lead block may weigh up to 1,000 lb.

Hanging Lamp Fashioned in Hurricane Style

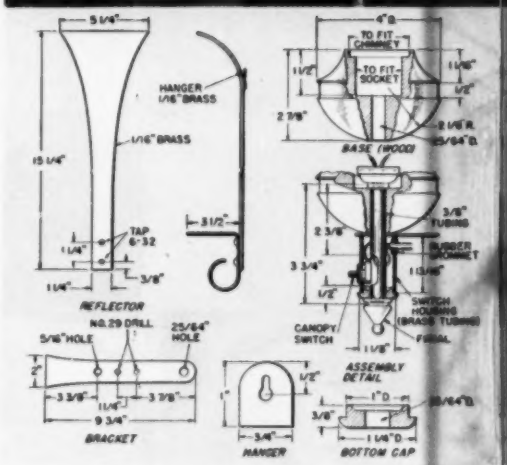
THE design of this colorful wall light was adapted from a Colonial hurricane lamp. Its overhanging reflector is lacquered brass, and the oil-reservoir section—turned from a 4¾" block of hardwood—is enameled to resemble colored glass. A ½" wide strip of brass encircles this turned base.

Before you start work you'll need a suitable chimney and a keyless socket, for the counterbore dimensions within the base depend upon the size of these items.

After sawing and filing the bracket and reflector from 1/16" sheet brass, locate and drill all the holes in both pieces. Thread the small ones in the reflector 6-32. Make a 90-deg. bend in the bracket ⅜" from the No. 29 holes. Shape the flared end into a scroll, fasten to the reflector with roundhead brass screws, cut the latter flush, and center-punch their ends. Form a freehand curve in the top of the reflector and make and solder on the wall hanger.

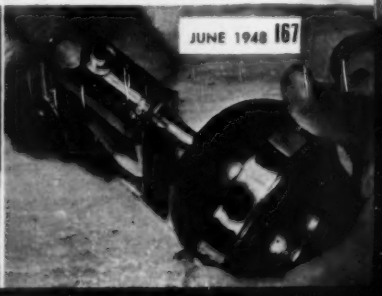
The lower assembly includes a 3¾" length of ⅜" tubing or a ⅛" pipe nipple inside a 1⅞" length of 1⅛" brass tubing. Drill holes in the larger tubing for a line-cord grommet and for the canopy switch that operates the lamp. Thread the ⅜" tubing at both ends and also file a notch opposite the switch to make room for it and allow entrance of the wires. Turn the end cap from 1¼" brass rod or form it from a disk of the 1/16" brass plate. Use a lampshade finial at the bottom. Buff all brass parts well and lacquer.

Tilt the switch at an angle, slide it into the tube and up through the mounting hole, and fasten with a bushing nut. Connect the switch and push the leads up through the small tubing. Use a grommet in the bracket cord hole.—*Bill Luther, Los Angeles.*



Lay out the bracket, reflector, and hanger on 1/16" sheet brass, using cardboard templates. File a slot (center) in the ⅜" tubing to give space for installation of a canopy switch.

Assemble the lamp by sliding the ⅜" tubing through the bracket and wood base. Thread it into the socket cap, connect the wires, and snap the shell into place in the cap.



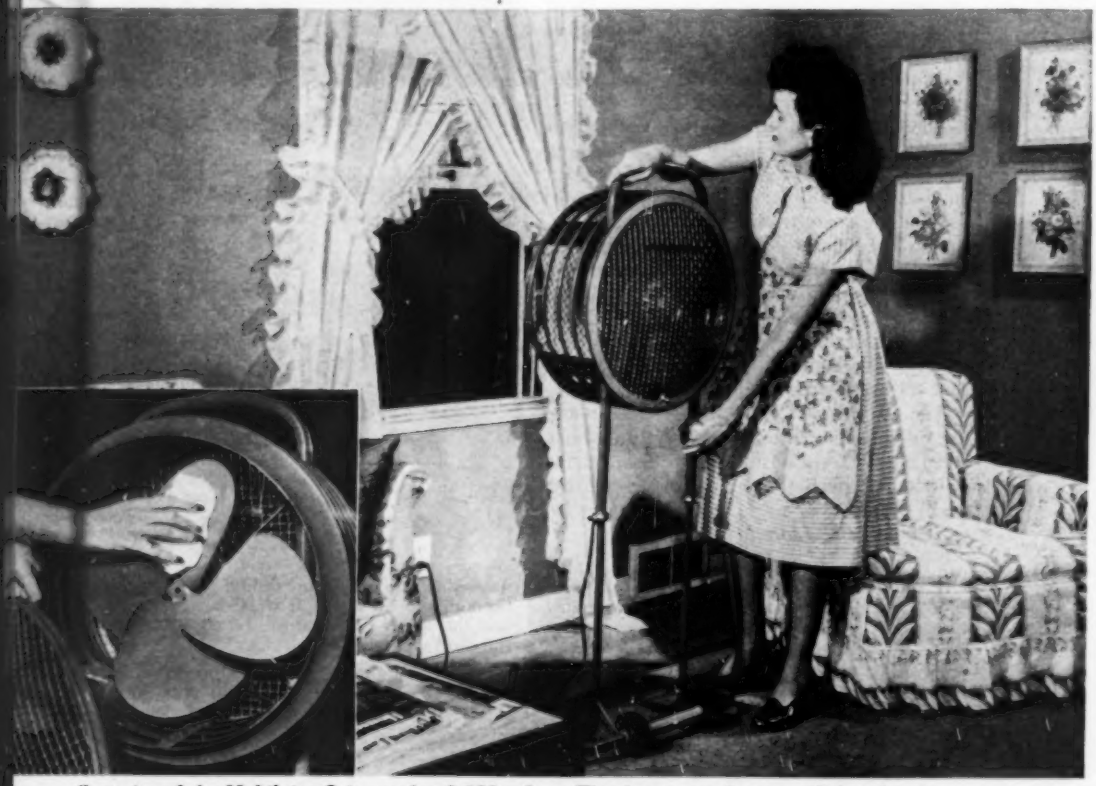
Buying Packaged Breezes for Summer Comfort

The sweltering season is coming up but so is a whole new crop of fans.

By Arthur C. Miller

SUMMER doesn't have to leave you as limp as boiled spaghetti if you learn how to live with the heat waves. Though there isn't much you can do about the outdoor climate, the proper electric fan in a house or office will give orders to the thermometer and make it obey.

The amount of control that one can exercise over the indoor weather depends on a number of factors. Dollars and cents are two important ones, but there are others, and it will do no harm to give them a little thought before resigning yourself to spending all



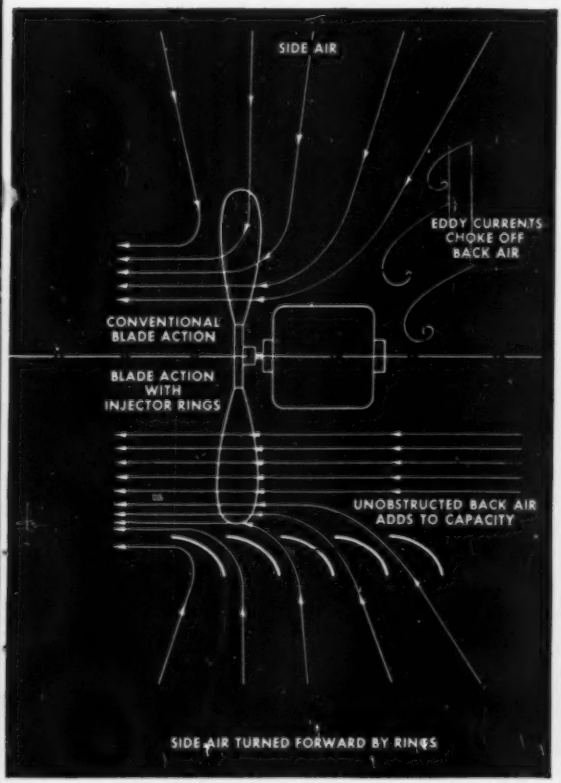
Capacity of the Mobilaire ⓣ is rated at 3,000 c.f.m. The front guard snaps off for cleaning.

your free time in an air-conditioned movie.

Your body doesn't make it easy for you to keep cool, because, like all operating machines, it generates heat. As the temperature of the air approaches that of the body, a hot envelope is formed that prevents the body from dispelling its heat fast enough to keep you cool. To feel comfortable, you have to break this envelope.

For five bucks you can give it a slight nudge—for that is about what you'd spend on a 6″ or 8″ nonoscillating fan with a shaded-pole AC motor. At close range one of these fans is capable of moving the air enough to give a cooling effect. While they won't refresh a room, or even do you much good if you move a few feet away, they are adequate within their limitations.

Next in the price scale is usually the 10″ job. Many of these are of the oscillating type—i.e., they turn from side to side as the blades revolve. They come a little higher (approximately $15 to $20) and do a some-



Here's how injector rings bring in back air.

BASIC FAN TYPES

SMALL HOUSEHOLD FANS

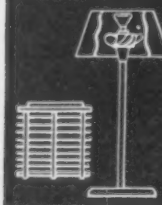
Air Displacement: 300-600 c.f.m.
Blade Sizes: 6″-10″
Rating: 30-40 watts
Price Range: $6-$15

LARGE HOUSEHOLD FANS

Air Displacement: 700-1,700 c.f.m.
Blade Sizes: 12″-16″
Rating: 50-90 watts
Price Range: $15-$35

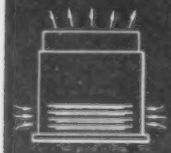
EXHAUST FANS

Air Displacement: 4,000-16,000 c.f.m.
Blade Sizes: 20″-48″
Rating: 250-550 watts
Price Range: $90-$190



COMBINATION FANS

Air Displacement: 300-1,500 c.f.m.
Blade Size: 10″-12″
Rating (Motor): 40-100 watts
Price Range: $35-$90



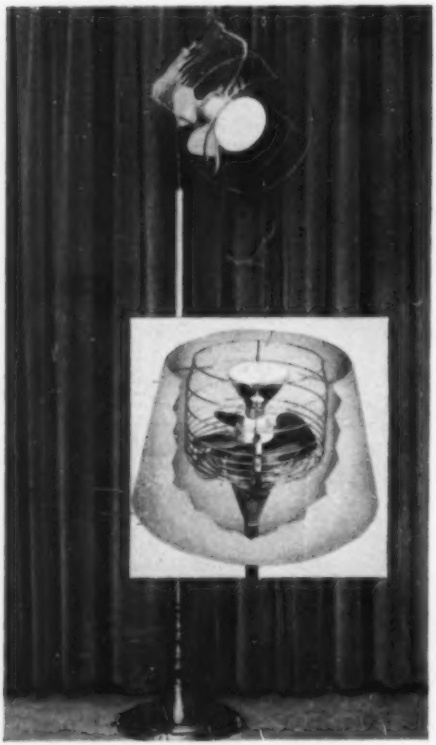
FLOOR FANS

Air Displacement: 900-3,000 c.f.m.
Blade Size: 12″
Rating: 80-130 watts
Price Range: $30-$65

INJECTOR-RING FAN

Air Displacement: 2,250 c.f.m. Low
3,000 c.f.m. High
Blade Size: 16″
Rating: 100 watts
Price: $70

Streamlined, but still standard, this type of fan is the leading personal and home cooler.



With its shade removed, the Fanlamp Ⓣ may be inclined as shown and used for direct cooling.

what better job in that they will cool two or three people in a portion of a room.

Assuming that your needs can be satisfied by a small fan, here are some of the things to look for when you go buying:

Does the fan have a convenient carrying handle? Small fans are apt to get pretty hot after they've been going for a while, and a handle will save your fingers.

Does it have a tilt adjustment? When you want to keep the airstream from playing with the papers on your desk, a tilt adjustment with a wing nut gives you a better choice of fan positions.

How is it lubricated? New developments in metallurgy have given us porous metal bearings. Many fans have sealed-in, lifetime lubrication; others provide oil wells that hold enough lubricant for a season or more. Those that have neither must be oiled fairly frequently.

How many speeds does it have? On less humid days you will not require the strongest stream to puncture the hot-air envelope, so there is a definite advantage in having at least two speeds.

Is the blade well guarded? Since we're all subject to fits of absent-mindedness, there's no sense in buying a knuckle duster.

Does it run quietly? Practically no fans run quietly enough after they've been used for a year or two, so if a new one has an objectionable hum or rattle, steer clear of it.

Unless you're a person who spends his days rooted to a desk and his evenings in one armchair, you probably ought to think of cooling a room or house rather than just one or two occupants. Most city people find there is very little difference between indoor and outdoor temperature, even at night, so that cooling depends upon keeping the air in motion and thus preventing the humid envelope from clinging to the body. The size of fan that will do this inside any room or house depends upon the dimensions of the structure. Size in cubic feet is calculated by multiplying a room's three dimensions. Thus if the ceiling is 10′ high and the floor space is 10′ by 15′, the quantity of air that the room holds is 1,500 cubic feet.

Now you can move 1,500 or even 15,000 cubic feet of air simply by wiggling a pencil —if you keep it up long enough. When it comes to a particular fan, you want to know how long it will take it to circulate a given quantity of air. Under most conditions a fan will keep a room comfortable if it circulates

the total volume of air once every two minutes. Manufacturers generally list the air capacity of their fans in cubic feet per minute (c.f.m.), and this is an important thing to look for when making a purchase. This figure should be about half the cubic content of the room that you want to cool.

Some fans are based on the sound observation that the coolest air is lurking about under your feet. This cool air normally stays down below while the warm air rises and settles around you like a fog. Vertical fans that operate from floor level not only stir up the air around you, but also exchange it for the cooler air near the ground.

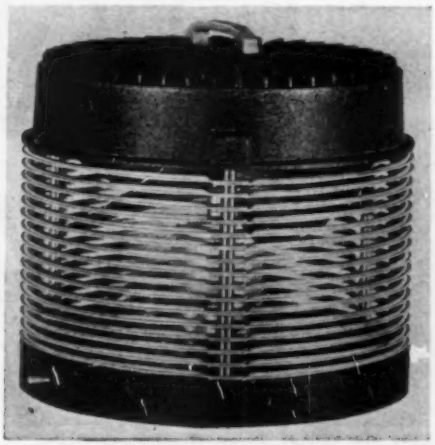
Combination fans almost speak for themselves. Two models shown in these pages are the Walton Fanlamp Ⓣ and the LeJohn Circulator Ⓣ. Both of these are vertical fans; the former incorporates a lamp, and the latter a heating element. The fan and lamp combination, which retails for $75 up, is a handy thing for a small office or reception room, and good to have over a card table when the session gets smoky. With the lampshade as a funnel, smoke is drawn quickly up to the ceiling and can escape through the top of an open window. Lamp and fan operate independently.

For the next few months the heating element in the LeJohn combination is not likely to interest you much, but when the first nippy days start coming back you may enjoy a few warm breezes. Fan and heater are independent, and the whole works come to $35.

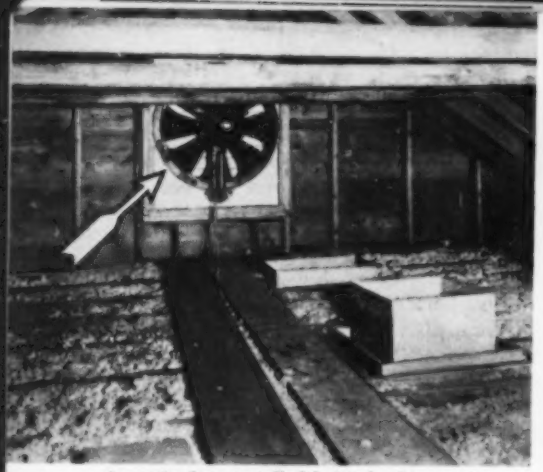
Suburbanites and country dwellers face a somewhat different problem when it comes to cooling a home. Wherever the night air is cooler than the accumulated heat inside the house, you can get maximum relief from summer weather by bringing the outside air indoors. There are two types of fan that will do this job well—the portable pedestal fan, and the fixed attic exhaust. Westinghouse has developed an injector-ring fan that will work well in a medium-sized house or apartment. When placed 3′ from an open window, the Mobilaire Ⓣ exhausts the hot house air, exchanging 6,000 cubic feet of it every two minutes for cooler outdoor air, which is drawn in at other windows. The 16″ laminated-plastic blades used in this unit are surrounded by five curved annular rings called air-injector rings. These rings are said to increase fan efficiency by approximately 30 percent over conventional fans. Normally a fan pulls air in from the sides only and sets up interfering currents that block back air. The injector rings regulate the side air stream and give the back air a clear channel. Although it looks hefty and does a man-sized job, the Mobilaire weighs only 35 lb. and can be moved about easily on its rubber-tired rollers.

With hot air rising all day, you can imagine how much of it has accumulated in the attic by nightfall. If this were cleared out, the slightly cooler air below could rise, allowing still cooler air to come in. Prices for good attic fans range from about $90 to $200, although you can go much higher

The heating element under its lid allows this LeJohn circulating fan to blow hot or cold.

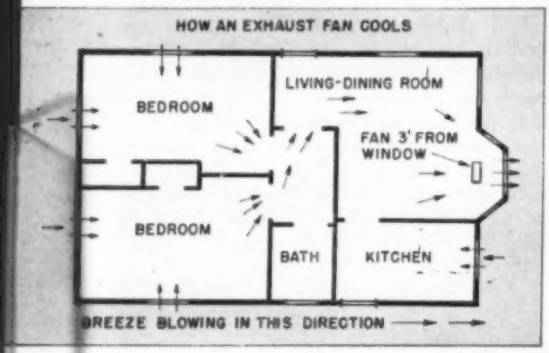


Floor fans, like the MotionAire Ⓣ above, work by circulating cool air vertically from the floor.



An attic fan, installed behind a louvered opening, exhausts hot air from the house at night.

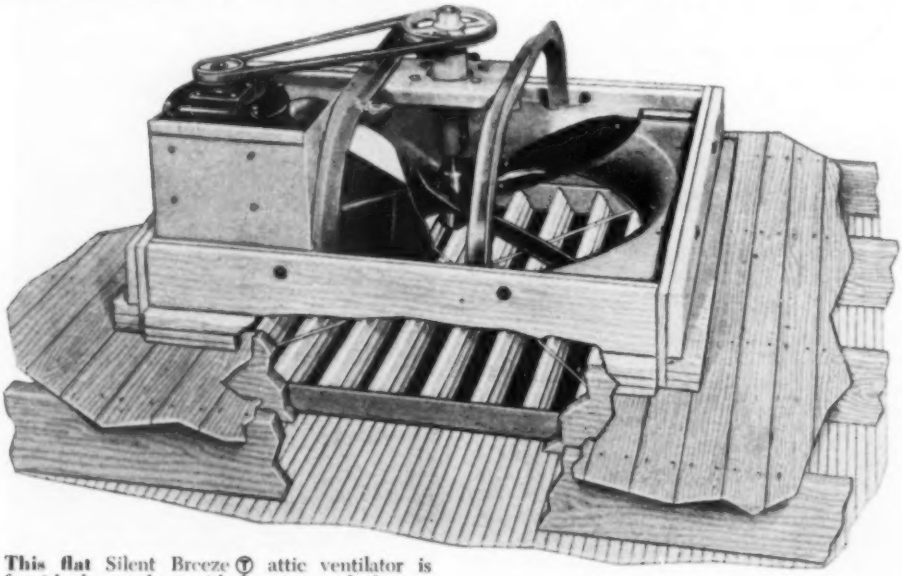
No permanent installation is needed when the Mobilaire Ⓣ is used as an attic exhaust fan.



for special installations. Size again depends upon the cubic content of the house you're interested in cooling.

Some attic fans are installed (with their blades in a vertical plane) behind louvers or shutters. Others are installed horizontally over a ceiling hatchway, exhausting through louvers or other attic openings.

The diagram at the left shows how air currents travel through the house; an exhaust fan draws heat from other rooms, thereby encouraging cool air to rush in and make the whole building more comfortable both by day and by night. END



This flat Silent Breeze Ⓣ attic ventilator is furnished complete with housing and shutter.

Anyone with a lathe can build rustic-style pieces for cabin, home, porch, or lawn.

Furniture From the Forest

This room was furnished from the woods. Only the cushions and flat boards were bought.

By Geoffrey T. Marris

MOST rustic furniture has a shaggy, backwoods look that will win no beauty prizes. This set, which can be made without difficulty from small cedar logs, has light, clean lines that suit modern tastes. While a wood lathe will speed up the job, you could turn out the smaller pieces with hammer, saw, bit brace, and drawknife.

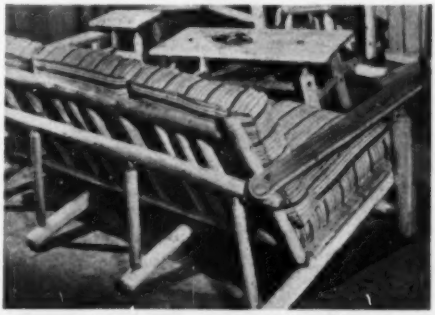
If you live in a town or city, materials can often be had by dickering with a farmer or landowner. Try to locate a dense second growth of cedar. From this you can probably cut sufficient dead material that's already fully seasoned. Select trees 1½" to 3" in diameter and cut them into convenient lengths. If there are no dead trees, cut green ones and dry thoroughly before use.

White cedar is the best material, spruce an excellent second choice. The grain of the latter may raise, however, unless the wood is very dry. For flat surfaces, such as chair arms, use red or yellow knotty pine. This blends well with either cedar or spruce when a natural finish is applied.

Begin with something relatively simple; for instance, a stool. This accomplished, make a bench, treating it as an elongated stool. From there, progress to a coffee table —simply a wider stool. By this time, you will have acquired the feel of the work, and may choose from the entire field of rustic furniture. The variety of possible pieces is almost endless.

Let's see how a stool is made. From your stock select and cut one 2½" log 14" long, four 2¼" pieces 17½" long, two 2" pieces 12" long, and one 1¾" piece 13½" long. All diameters are of course approximate. In assembling vertical members place the smaller end at the top.

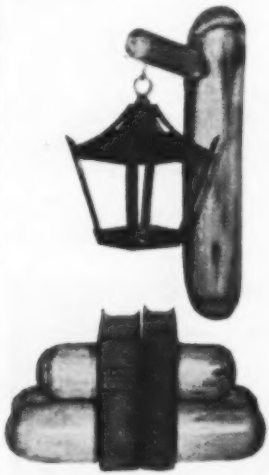
Put each piece in succession in a vise and peel with a drawknife. Remove only



Tenon joints secure most members, but where two pieces cross, carriage bolts should be used.

A table is just a big version of the bench. In turn, each resembles the small stool below.

Cushions for the chair on facing page are 21" by 25" and 21" by 21", each one being 4" thick.



Small pieces may also utilize cedar logs. The book ends above were assembled out of scrap left over from several of the large projects.

the bark and a veneer of sap wood. Be careful to keep the blade from digging in. Cut off any large hard knots with a chisel and smooth with a small plane. This done, the poles are ready for the lathe.

Using a tailstock support, round off each end of the 14" piece. I found this easiest with a very sharp 1" flat chisel, ground to a slightly sharper angle than normally used for bench work. In fact, at no time during the building of this furniture was any other chisel used.

Treat the four 17¼" pieces—the legs—in the same way, except that a dowel 1⅛" in diameter is turned on the smaller end. Make each dowel about ½" longer than the depth of the hole into which it is to be fitted. Turn similar dowels on each end of the three bracing pieces. Sand all the pieces smooth before removing from the lathe.

Now cut the two 1" by 6¾" by 13½" seat boards to size. A slight chamfer on the abutting edges will improve the appearance of the finished article.

Saw or split the 14" pole down the middle and smooth the flat faces. Attach under the seat boards with glue and 1¾" flathead screws. When the glue has dried, trim off the protruding ends of the crosspieces. Also round the upper edges of the seat. Fill the countersunk screw holes with composition wood and sand smooth.

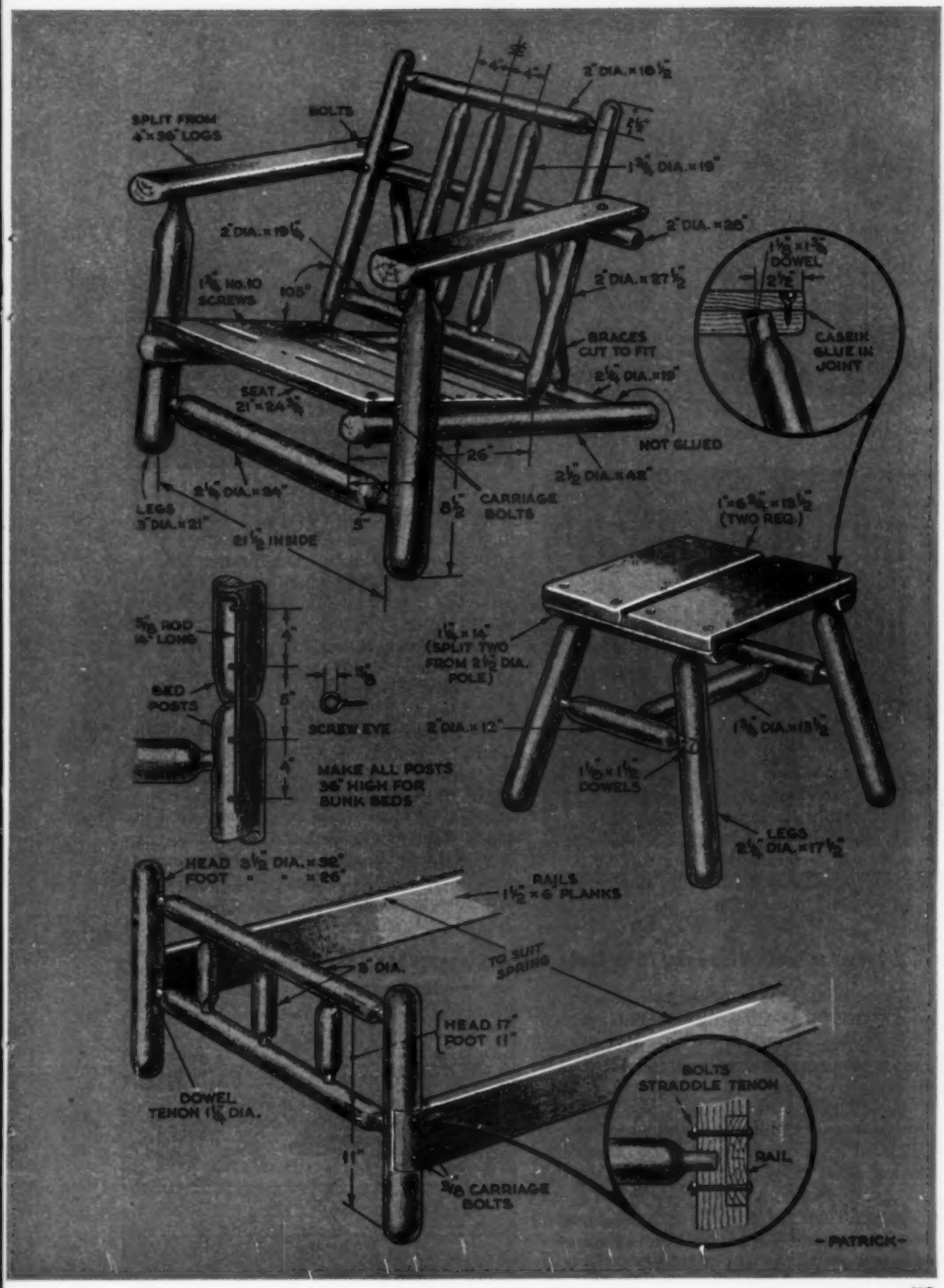
Drilling for the dowels is the trickiest job of all. Put the seat face down on the bench and mark centers for the leg-dowel holes. Set a bevel square at 8 deg. off the vertical, line the brace and bit so it is leaning outward at an angle of 98 deg. with the seat, and drill until the glue line is reached.

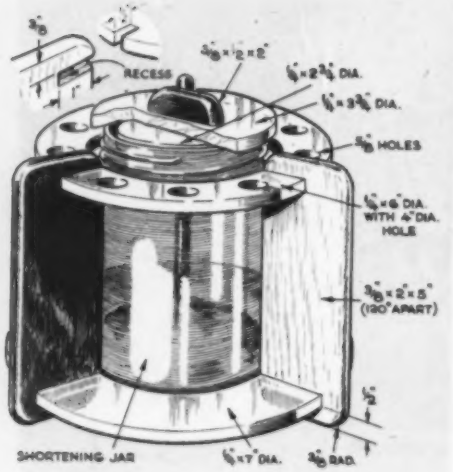
Drill the holes in the legs half way along their length, leaning the brace 8 deg. toward the dowel end. Drill the two side braces with the bit at 90 deg.

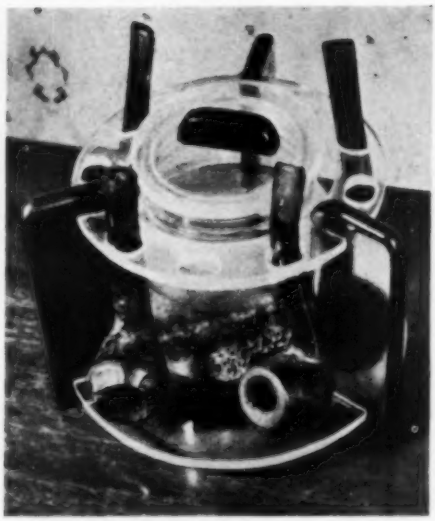
Put glue in the dowel holes and assemble the stool. When the glue is dry, check to make sure the legs are square on the floor. Three coats of clear lacquer, sanded lightly between coats, complete the job.

You're now ready for something more ambitious—a bench, table, chair, bed, or other item, chosen from the accompanying examples or designed on your own.

Arms for the chair and sofa are 4" logs split down the middle. It's best to cut, peel, and rip these while they're still green, for small cracks often mar material of this size that's cut when dry. END


SPLIT FROM 4"×36" LOGS
BOLTS
2" DIA.×19½"
1¾" DIA.×19"
2" DIA.×19¼"
2" DIA.×26"
1¾" No.10 SCREWS
105°
2" DIA.×27½"
BRACES CUT TO FIT
2½" DIA.×19"
SEAT 21"×24¾"
NOT GLUED
26"
2½" DIA.×42"
2¼" DIA.×24"
CARRIAGE BOLTS
LEGS 3" DIA.×21"
5"
8½"
21½" INSIDE
1½"×1¾" DOWEL
2½"
CASEIN GLUE IN JOINT
1"×6¾"×13½" (TWO REQ.)
5/8" ROD 14" LONG
4"
BED POSTS
8"
SCREW EYE
4"
MAKE ALL POSTS 36" HIGH FOR BUNK BEDS
1¼"×14" (SPLIT TWO FROM 2½ DIA. POLE)
2" DIA.×12"
1¾" DIA.×13½"
1½"×1½" DOWELS
LEGS 2½" DIA.×17½"
HEAD 3½" DIA.×32"
FOOT " " ×26"
RAILS 1½"×6" PLANKS
5" DIA.
TO SUIT SPRING
HEAD 17"
FOOT 11"
DOWEL TENON 1¼" DIA.
11"
5/8" CARRIAGE BOLTS
BOLTS STRADDLE TENON
RAIL
-PATRICK-





Pipe Rack Contrasts Ebony and Plastic

CLEAR plastic and polished ebony are pleasingly combined in this pipe rack and humidor, but it might also be made of colored plastic and wood, plastic alone, or all wood. In this case, the humidor is a jar that originally contained shortening.

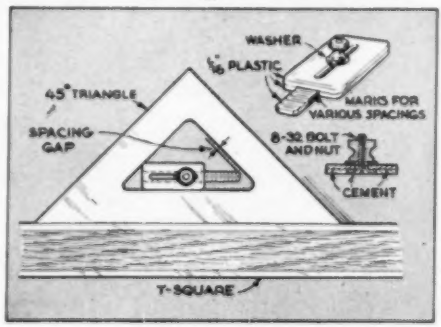
The humidor jar rests on a 7" disk of ¼" plastic and is retained at the top by a 6" plastic ring that has a 4" hole. Interlocking notches join these plastic parts to three wood uprights 120 deg. apart. The notches in the uprights are ½" deep; another ½" is recessed both sides to enter the notch in the plastic. A 2¾" disk cemented under the lid serves as a retaining flange. The handle is another piece of ebony.

After sawing the plastic parts, smooth the edges with a file and sandpaper, ending with No. 400 Wet-or-dry Ⓣ paper, used with water. Then buff to a high gloss. If you like, you can file and sand the pipe holes to elliptical shape to conform to the pipe stems. Fasten the parts together with cellulose cement. If the finish applied to the wood parts contains oil, be careful to keep it out of the joints, for this would prevent the cement from holding. Round the edges of the wood parts and finish in any conventional manner.—*E. D. Groves, Winfield, Kan.*

Adjustable Guide Produces Equally Spaced Lines

DRAFTSMEN will find this little adjustable device helpful in drawing crosshatching or lines of any desired spacing. It may be used for horizontal and vertical lines as well as for the 45-deg. lines shown.

A line having been drawn, the guide is held stationary while you slide the triangle left until it's stopped by the tongue of the guide. After drawing a line, you hold the triangle stationary and move the guide to the left. Then the triangle is again shifted and another line drawn.—*A. D. Guagliardo, Milwaukee, Wis.*



Intricate scrollwork makes this candy dish a challenging project for the jigsaw enthusiast.

Jigsaw the pattern with the plate face down on the table.

Lace Design Cut in Candy Plate

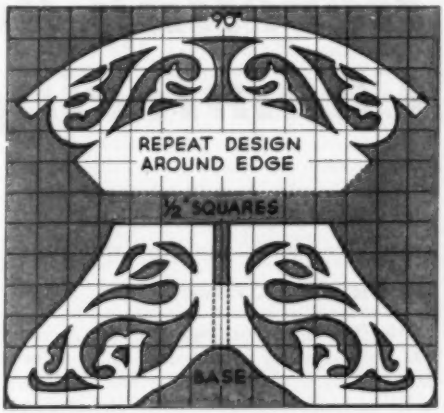
ALTHOUGH this lacy-edged candy plate might be made of almost any kind of hardwood, gumwood for the plate and holly for the stand present a nice contrast in color and grain.

After cutting a 10″ disk from stock about 1½″ thick, rout out grooves ⅝″ deep, ¼″ wide, and 3½″ long, crossing at right angles at the center of one side. These take the two parts of the stand.

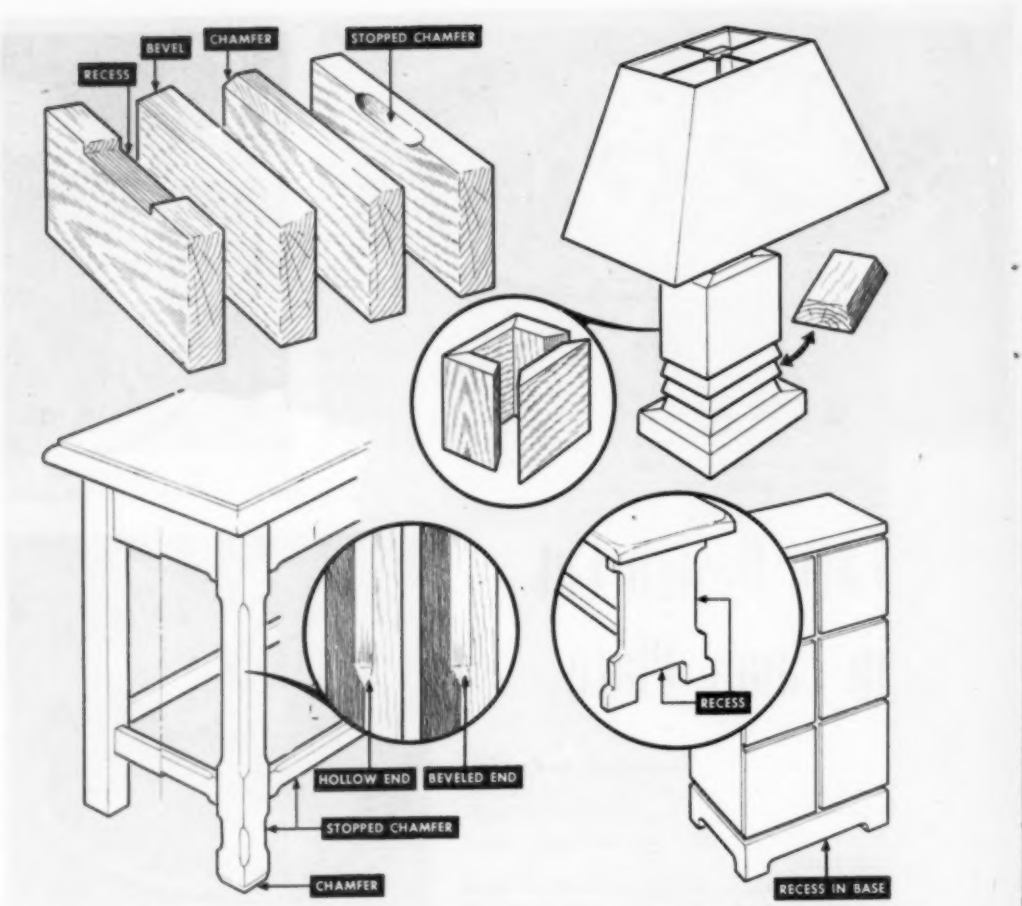
Tack a faceplate of scrap wood over the grooves and turn the disk to plate shape, thinning as much as desired and making the completed job 9½″ diameter. Lay out the edge design on tough manila paper and transfer to the underside of the plate. Since this is a reverse repeat design, your pattern will need to include only the 90-deg. section in the accompanying drawing.

Although the cutting job is easiest with a power saw, it could be done with a coping saw if you work carefully. In laying out the two parts of the stand, note that the notch is in the upper half in one, and at the bottom in the other. Slip one into the other like the separators in an egg carton. Glue the parts together after sanding, shellacking, and waxing.—*E. Waltner, Hurley, S. D.*

Glue the stand in grooves cut at right angles in the plate. Shellac and wax the finished job.



Draw the patterns on paper and then trace. For the plate, you need just the part given above.



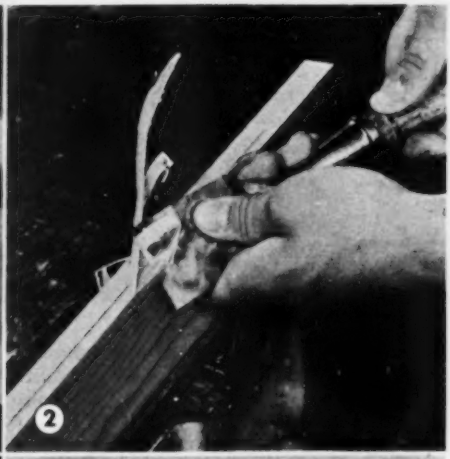
Beveling and Chamfering by Hand

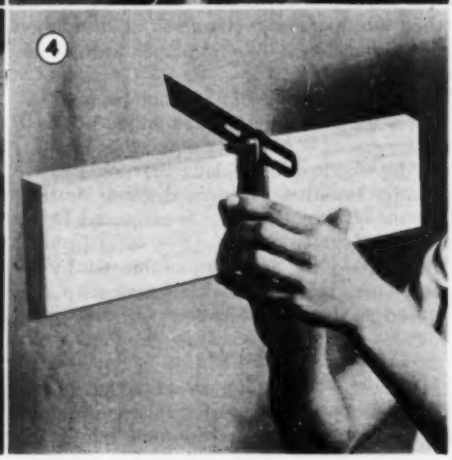
These simple hand-tool operations will make almost any exterior edge more decorative and eye-appealing.

By Edwin M. Love

THERE are countless uses for boards with squared edges and ends. They fit in nicely as shelves or partitions, and as sides and tops of simple pieces of furniture. But sooner or later you will want to enliven plain lines with the touch of ornament and variety that you can get with chamfers, bevels, and recesses.

A chamfer is made by trimming off an arris, usually at a 45-deg. angle. Besides being ornamental it is utilitarian since it blunts the sharp angle and reduces wear. Stretchers of refectory tables where monastery monks parked their feet to keep them off the drafty floors were often chamfered. In grandfather's day chamfers on square

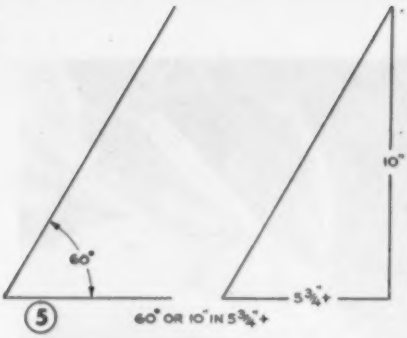




porch columns forestalled dents from busy rocking chairs. Some of the uses of chamfers in furniture are illustrated in the drawing at the top of the facing page.

The guide lines needed for chamfering are drawn with pencil as in Fig. 1, or by using a combination square in place of the fingers. Don't use a marking gauge, for the scratches it makes will remain to mar the work. Trim off the arris with a sharp chisel. Rough out the chips with the bevel side down (Fig. 2), rocking the chisel edge up when it threatens to cut below the line. Work with the grain as far as possible. Final paring is done with the flat side of the chisel down. Smooth with a plane or cabinet file, according to the space or location of the piece. Placing your fingers between the sole of the plane and the work as in Fig. 3 will help you to steady the plane and establish the angle by feel. Cut a narrow chamfer entirely with the plane. The small amount of stock to be removed does not warrant a roughing cut with a chisel. A block plane used with a skew cut works especially well for chamfering the end of a board.

More interesting than the ordinary chamfer is the stopped chamfer, which does not extend the full length of the piece. Usually the stopped ends are hollowed or beveled, but sometimes—if the chamfer is made for a joint—the ends are cut square in. A plane cannot be used on a short stopped chamfer, so the bottom has to be finished with a chisel or, if the wood is cross-grained, with a cabinet file. Slide the file sideways on the stroke to cover the work evenly. Lifting it on the backward stroke saves wear and gives



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better control. The file used for finishing should be well taken care of. Do not use it on metal, and don't toss it into a drawer with other files.

A hard block backing should be used when sandpapering chamfers. Guide the paper and block like a plane and avoid rocking.

Check the angle of the chamfer with a sliding tee bevel—more often called a bevel square—using it like a try square, as in Fig. 4. On woodworking plans the angle of a chamfer is either given in degrees, or the amount of rise of one leg is measured from a base of given length (Fig. 5). In the first method the bevel square is set by a protractor. In the second, a framing square is used as shown in Fig. 6.

Bevels

A bevel is a chamfer so wide that it includes the entire edge of a board. Among its uses are ornamental sloping bands in modern designs, and miters for column joints, both employed in the lamp design shown at the top of page 178. To change a squared edge to a bevel, mark the angle on the end of the piece and gauge a guide line for the lower arris. Marking and gauging are the same as for chamfers.

Plane the angle if it is only a few degrees off square. Use a drawknife or a chisel if it is greater and considerable stock must be removed. Finish with a plane (Fig. 7).

Sawing a bevel is often preferable to chiseling. Gauge a guide line, or—if the edge of the board is rough—draw it with a straightedge. Mark the angle on the end of the piece, incline the saw blade to left or right according to the angle, and rip to the line. A block cut to the proper angle and held against the blade and the board helps to maintain accuracy.

Ripping is especially useful when a number of beveled strips must be made from one board, since one bevel cut makes two beveled edges. The overlapping of the edges also saves material. Usually very little planing is needed to smooth a ripped bevel.

The sharp edge of a wide bevel is fragile and therefore offers a poor base for gauging

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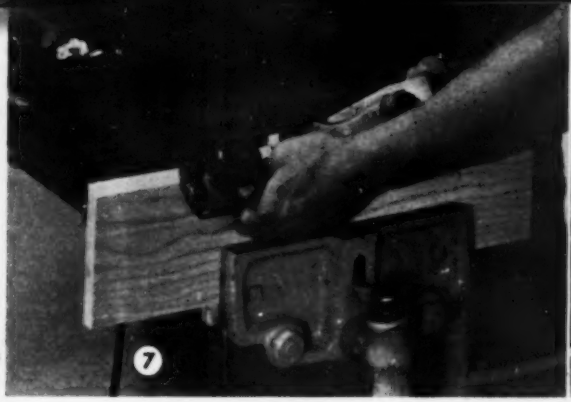


the width of the piece. For this reason, when marking a beveled piece to width, it is best to measure the width and draw the line along a straightedge.

Generally an end bevel should be sawed, although paring with a chisel is often convenient with thin stock. Planing follows the rules for end chamfering. Splintering of the back can be avoided by clamping a waste piece against it before planing.

Recesses

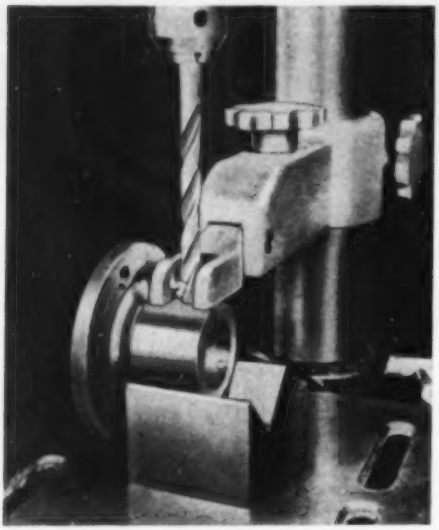
The lower right-hand units in the panel on page 178 illustrate some decorative uses of recesses in furniture design. In power-tool jigs and other gadgets made in your shop such notching is a means of detouring two pieces around each other.

A guide line need only be drawn on the face for many recessing jobs, but when working with thick stock a line on the back is a real help. Cross-score the edge with a chisel, as in Fig. 8, beginning about 1/16" from an end to avoid crushing the corner. Lean the chisel toward the bevel for easy shearing cuts. This breaks up the waste strip and prevents it from splitting into the board below the line. The sequence of rough and paring cuts, illustrated in Figs. 9 and 10, is the same as that described above for chamfering. Smooth the bottom of a recess with a plane or cabinet file (Fig. 11), and trim the end by chiseling straight down as shown in Fig. 12.

Recessing an end is a bit more difficult. There is no problem of splitting into the work, so cross-scoring is unnecessary. But a chisel driven by heavy mallet blows may tear pits in the end grain. Lay the piece on the bench with a protecting block beneath it, and chisel from both sides. Clamp the work in the bench vise and pare along the line with the chisel bevel up. Swing the blade sidewise for a shearing cut.

When the recess is long enough to make it worth while, cut it with a saw. Chisel an end to depth or bore a hole; then start the cut with a compass saw as in Fig. 13. Finish with a hand saw if there is room. A back saw is convenient for cutting the ends (Fig. 14) but an ordinary saw will serve very well. END

NEW TOOLS



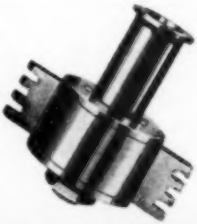
Work Clamped in Drill Press. This holder adjusts up and down on any round-column drill press to suit work of different dimensions. Adjustment also may be made by sliding the forked jaw in and out. As seen here, the holder is used with a V-block for drilling round work. Flat stock is simply clamped down against the table. The Pacific Coast Sales Agency, San Francisco, offers it for about $10.

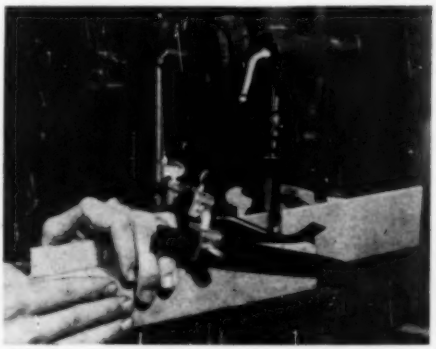
Small Magnet Is Powerful. Although only slightly larger than a package of cigarettes, a permanent magnet produced by the Ronald Eyrich Co., of Milwaukee, Wis., has unusual holding power. As seen here, it will pick up a large number of small parts. It will also support a heavy coal shovel with only the sharp edge of the shovel touching the magnet. On a flat steel surface it has a pull of about 40 lb. before separation occurs. The retail cost of the magnet is about $2.

Screw Holder. A gadget for inserting screws in restricted spaces is produced by Screw Starter, Inc., of Denver, Colo. Pressing down on the handle causes the dual bits to twist in opposite directions, wedging them in the screw slot. Pushing a knob at the end of the handle frees the screw. The starter is made in several sizes.

Shaper Accessories. The Barron Tool Company, of Detroit, has introduced an all-metal fence and a new type of molding-cutter head, both of them for use with shapers and drill presses. Blades are retained in the cutter by ears that fit into slots in steel compression disks at the top and bottom. In addition to full-width blades, a split-blade design is offered. When employed in matched pairs, the half blades provide a number of standard shapes and molding contours. Used in different combinations, they give varied molding designs.

The fence plates are made of aluminum, and the right-hand one is adjustable by a vernier screw for infeed and outfeed. Twin hold-down springs with separate adjustment screws provide two-way tension on work of various sizes. The fence sells for about $8, the cutter for about $9.





Nonslip T-Square Rolls on Gears

RIDING up and down a 36″ by 48″ drawing board on rack-and-pinion controls, this precision T-square may be locked in any desired position. A ¼″ steel shaft rotating in pillow blocks keeps both ends at exactly the same height. The entire blade assembly can be lifted off the board when not in use.

Racks 3/16″ square fit in grooves 5/16″ from each edge of the board. The depth of these grooves will depend somewhat on the diameter of the pinion. When the shaft has been properly fitted in the pillow blocks, you can push the blade freely up and down the board. Close adjustment is made with the 2″ radio knobs at each end of the shaft. For still greater precision, a vernier action might be added to one knob.

The table top, made from ¾″ plywood, was grooved on the circular saw for the racks. A snug press fit holds them securely.

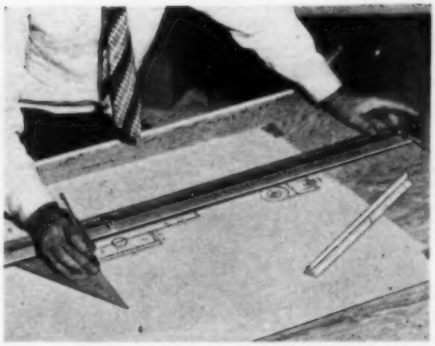
Taken from a T-square, the blade was cut to slide freely between the racks, and the pillow blocks were fastened to it with flathead machine screws countersunk in the lower face. Three pillow blocks are required to keep the long shaft from flexing.

Thumbscrew Locks Blade

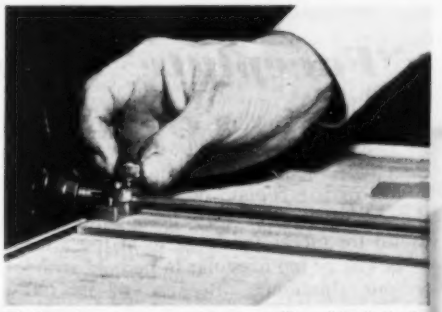
So that the shaft may be locked to keep the blade in any desired position, the upper part of one pillow block was removed and its lower face ground down. One of the pillow-block screws was next inserted to the point where the shaft wouldn't turn, then backed off slightly, and locked with a set screw turned up from underneath. With this adjustment made, tightening a shouldered thumbscrew in the other pillow-block hole prevents the shaft from turning.

When the job is complete, the pinions should ride on the racks without play, and there should be a paper-thickness clearance between the lower face of the blade and the table. This clearance may be varied by grinding off the bottoms of the pillow blocks or by shimming them up.

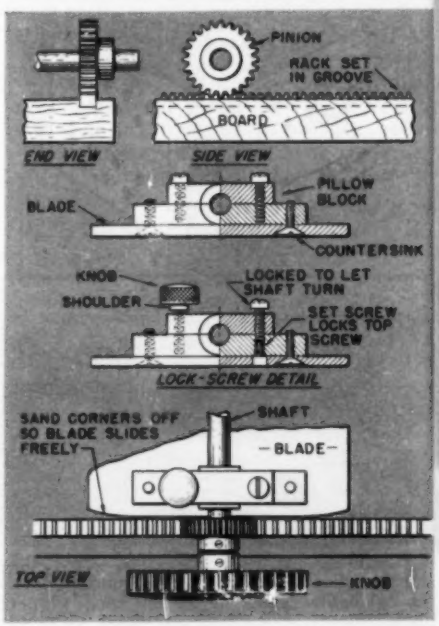
After the blade assembly has been lifted off, always replace it with the lower edge against the retaining strip at the bottom of the table.—*Charles T. Pearson, Chicago.*



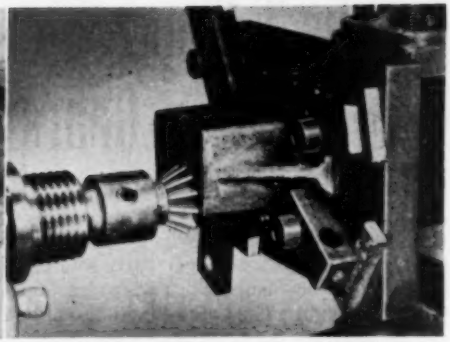
An easy push slides the blade up or down the board. Pillow blocks keep the ¼″ shaft rigid.



Tightening a screw in one pillow block locks the shaft, preventing the blade from slipping.



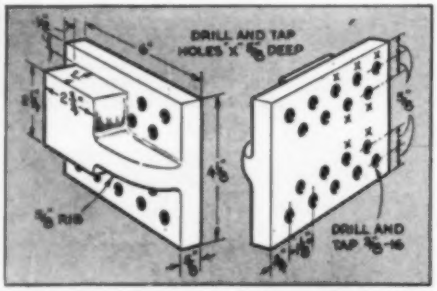
The finished adapter, as seen from the back. Note that the rib is centered on the plate but offset on the boss that fits in the vise.



Set up for use, the adapter will readily take a piece of work that would be very difficult to mount directly in the milling attachment.

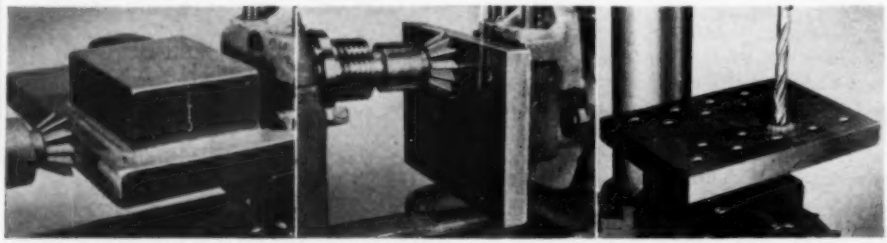
"Faceplate" Aids Milling in Lathe

YOUR lathe milling attachment becomes much more versatile with one of these "faceplate" adapters. A simple iron casting, it acts as a faceplate on which irregularly shaped workpieces may be mounted. It's useful for pieces too large to fit the attachment vise or too irregular to be held without tedious shimming. Because of its offset shape, it actually increases the length of work that can be milled at one setting.

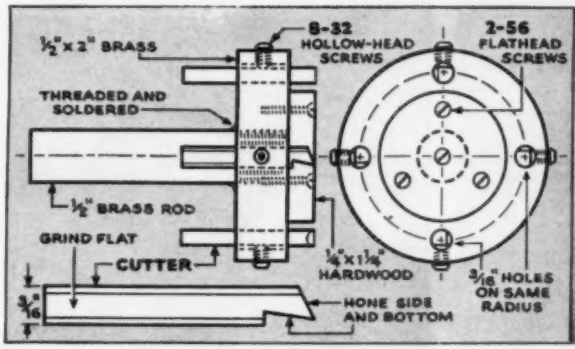


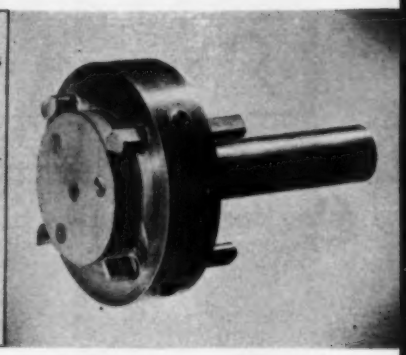
Make a pattern for the adapter, using any close-grained wood, sand it smooth, and add wax fillets. (The dimensions given are correct for the milling attachment of a common bench lathe, but can of course be modified to suit. In any case they should permit a small mill to sweep the entire surface of the plate.) Shellac the pattern and take it to a foundry.

When you get the casting, square up the sides with light milling cuts. Then bolt the adapter to the attachment so you can mill the back of the clamp block; when finished this should set flush against the back of the milling vise. Clamp the casting in the vise as in use and, with the milling attachment set accurately at 0 deg., take a light finishing cut over the entire work face. Drill and tap for the hold-down bolts; the holes not marked with an X in the drawing are through ones.—*John A. Bates, Wise, Va.*



A skimming cut, left, dresses one side of the adapter when it comes from the foundry. Make the cut light because of the overhang. Center photo shows the finishing cut being given to the working surface. Drill and tap the mounting holes, right, in a drill press. Holes that are marked with an X in the drawing are blind, since they are opposite the vise boss.





Making Your Own Rotary Planer

SMOOTH, flat cuts are produced on wood with this rotary planer when it is spun at high speed in a drill press. It uses broken drill shanks as cutters. Building it is a fairly simple lathe job, though you'll want to take pains to get the tool true-running and balanced.

For the shank, use a 2½" length of ½" steel or brass round stock, and for the head a ½" by 2" steel or brass disk. Thread ½" of the shank with any convenient ½" right-hand thread, drill and tap the disk to match, screw them snugly together, and use a torch to run solder into the threads. Attach a hardwood pad to the disk with 2-56 screws, which should be countersunk slightly. Then chuck the tool in the lathe and take light cuts until all surfaces run dead true.

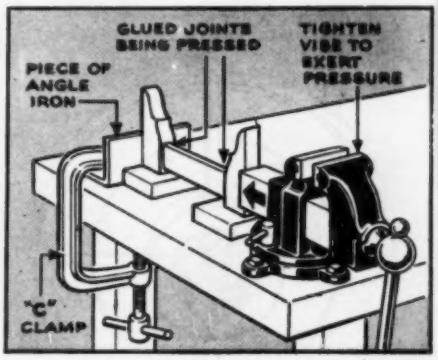
The cutter holes must be drilled on the same radius. I held the planer in a drill-press vise and clamped the vise on its side on the drill-press table, in position for the first hole. Then I merely loosened the vise jaws a trifle to turn the planer a quarter turn for each of the other three holes. Four radial holes should be drilled and tapped for the setscrews.

The shanks of broken 3/16" drills make excellent cutters, but if your scrap box doesn't have them, some 1¼" lengths of hardened drill rod will do nicely. Grind a lengthwise flat on each cutter, shape the front and bottom to provide a cutting edge, and hone to keenness on a fine stone. Set the cutters evenly (they should *not* extend beyond the hardwood pad) by resting the planer on a flat surface, pressing each cutter down individually, and locking it there. Do this each time the cutters are sharpened.

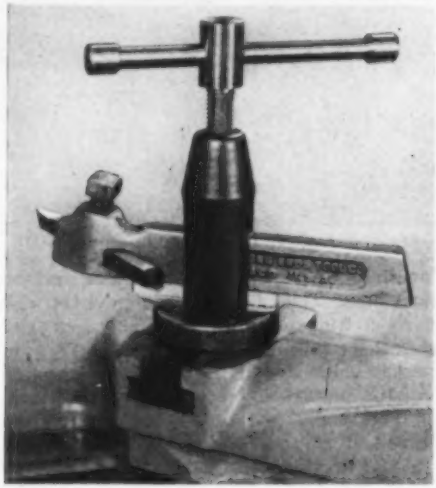
In use the tool will handle cuts up to ¼", and should be used at high speed with a fairly light feed. Keep your fingers well away from it. If successive passes produce a slight unevenness on the work, the table isn't square with the spindle. Readjust it until the tool produces a dead flat surface. —*Herbert R. Pfister, Bronx, N. Y.*

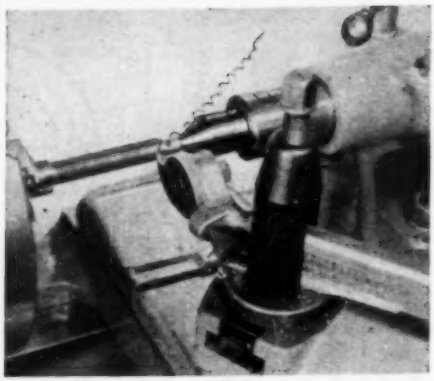
Vise Used as Furniture Clamp

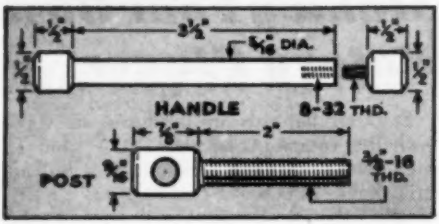
HAVING no furniture clamp suitable for gluing long pieces of work together, I improvised one by using the back of my machinist's vise, as illustrated at the right. The stationary jaw consists simply of a scrap of angle stock held tightly to the bench with a C-clamp. Blocks of wood elevate the work so that it receives straight, square pressure. The idea is especially handy in making glued repairs on long pieces such as railing spindles and the like. Do not use excessive pressure.—*Joseph Haines, Philadelphia.*

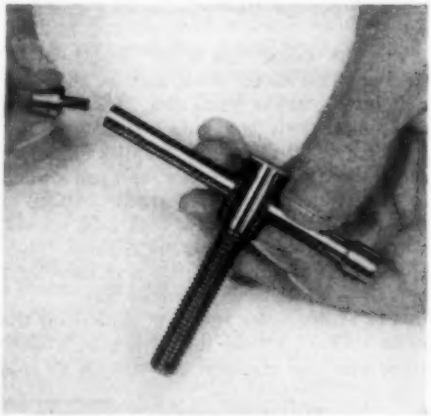


NEW SHOP IDEAS



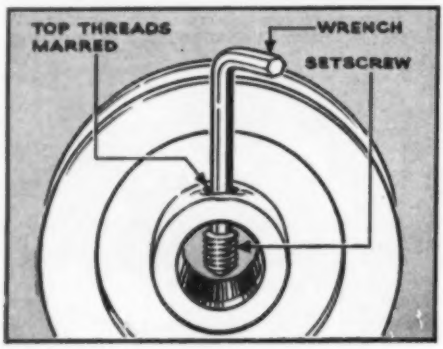






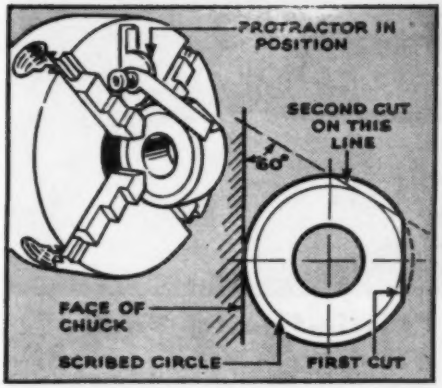
Tool Post Needs No Wrench. You don't have to search around the lathe bench for the tool-post wrench if you have this simple fitting. It's a great convenience in making quick adjustments of tool height and angle. The handle gives ample tightening leverage, and it readily slides back out of the way.

Two pieces of drill rod, one 9/16" and the other ½", will provide material. Or if you prefer not to turn the handle out of solid stock, it can be made by fitting two removable knobs to some 5/16" round stock. The vertical screw can be threaded either in the lathe (upper right) or with a die; the ⅜"-16 threads specified are correct for many small tool posts.—*Henry Hanscom, Elmhurst, Ill.*

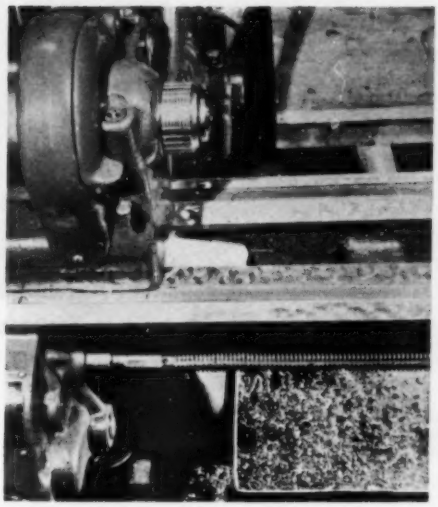


Screw Straightens Threads. Occasionally the upper threads in the setscrew hole of a die-cast pulley become so badly chewed up that the setscrew cannot be started properly. It's preferable to clean up the threads with the correct tap, but if none is at hand the kink at left will often do.

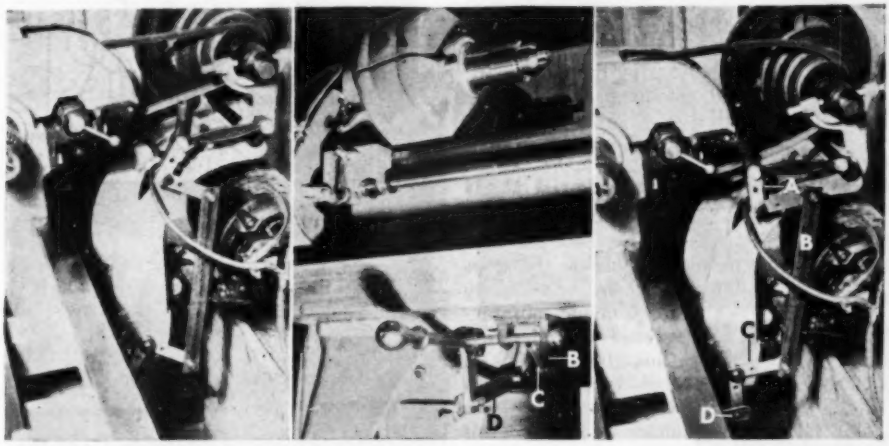
Dip the long end of an Allen wrench in some grease, insert it through the setscrew hole, fit it into a hollow-head setscrew that's been put in through the shaft hole, and carefully back the screw out from inside. As the screw comes to the damaged threads it will straighten them out.



Hexing Nuts. Here's a quick way to produce a hexagonal shape on special nuts. Scribe a circle having a diameter equal to the desired distance between flats, drill and tap the nut, and then machine a flat to the line, chucking the work in the four-jaw. Use a protractor set at 60 deg. to reposition the nut for subsequent cuts. To find the diameter of stock needed, multiply the desired distance between flats by 1.15.—*W. S. Gallman, McNary, Ariz.*

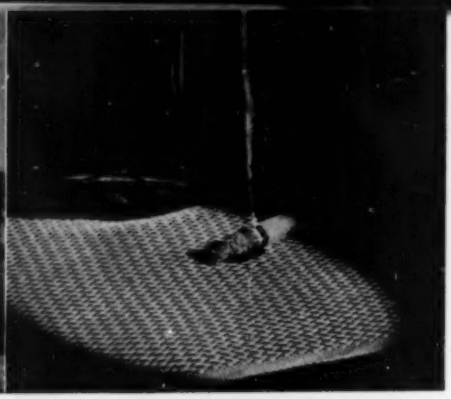


Chute Diverts Chips. Pans beneath the lathe ways won't catch turnings close to the headstock. A bent piece of sheet aluminum fitted between the ways at an angle will divert chips and coolant to the pan and keep them out from under the headstock.



Countershaft Lever Relocated. Although any device that will release belt tension on a lathe countershaft is a convenience, the release lever on some bench lathes is located behind the headstock in an awkward and even hazardous position. With a few scrapbox odds and ends I devised a lever system that brings the control handle out beneath the bench under the headstock.

At left above the rig is in the power-on position; the center photo shows the new control lever in the same position; and at right the linkage is pictured in the power-off setting. The original lever, which protruded from where bell crank A now is, was removed. Link B connects bell cranks A and C, and link D runs to the new control lever. Only one hole, that for the pivot bolt of bell crank C, had to be drilled in the lathe itself.—*H. L. Phillips, Watertown, Mass.*



Seat Covers Woven from Plastic-Coated Yarn

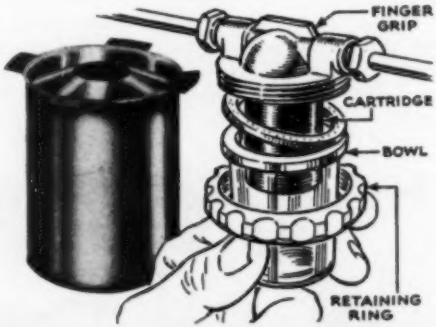
SEAT covers produced from a plastic-coated yarn called Plexon ⓣ are fire-retardant and impervious to grease, lipstick, acids, and rust. The covers are a product of Necessities Limited, Greenville, S. C.

A cigarette does little damage and Junior's art work is easily removed with a damp cloth. Made in Greenville by Plexon, Inc., the fabric consists of rayon or cotton fibers coated with plastic solvents. The product will also be used for decorative fabrics, upholstery, and draperies.

Filter Has Replaceable Screen

A REPLACEABLE cartridge screening element is a feature of a new gasoline filter announced by the Fram Corp., Providence, R. I. The company claims that when the element becomes clogged it's easier and cheaper to replace the cartridge (inset) than to clean the usual type of screen.

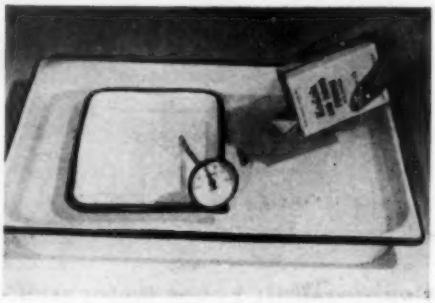
A finger grip lessens the chances of twisting the gas line when taking the filter apart, and the threaded retaining ring may be loosened by hand.



Old Wheel Used as Hand Rail

BELOW is an addition to our back porch steps that's both decorative and useful—a wagon wheel cut and fastened to the steps and side of the house as a hand rail. During the summer, morning-glory vines grow through the spokes.

A template for cutting the wheel was made by fitting scraps of stock to the steps and tacking them together. The wheel then was installed with lag screws. Plywood disks were placed over the hub and the wheel painted to match the house.—*Karl Greif, Binghamton, N. Y.*



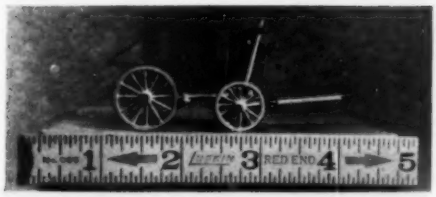
Hypo Cools Photo Solutions

A TRICK of chemistry will help you keep photo solutions at working temperature in warm weather. Place the developing tank, tray, or bottle of solution in cold water and toss in hypo crystals. The temperature will decrease until the water is saturated. Then pour it out and begin again with fresh water. —*Jack Wilson, San Pedro, Calif.*

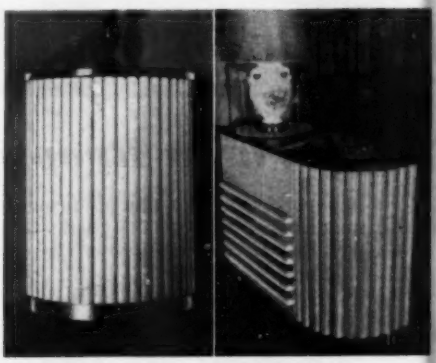
Craftsmen at Work

Three-Year-Old Runs Tractor. Powered by a ¾-hp. gasoline washing-machine engine, this little tractor was built by August Dobert, of Nashville, Tenn., for his three-year-old son. Pipe was welded together for the frame, and the steering rod runs through the frame, making the bend by means of bevel gears. The drive is a round leather belt from engine to countershaft, and a chain from countershaft to the right rear wheel. A pedal engages the drive and also acts as a brake. A trailer is easily pulled.

Surfboard Has Viewer. In building this surfboard from PS plans, Charles V. Ogilvie, of Jamaica, B.W.I., included a plate-glass panel through which the rider may view the ocean floor. Since the board is intended for use mostly on calm water it's equipped with a paddle. Framed with cedar, the board is made of plywood.

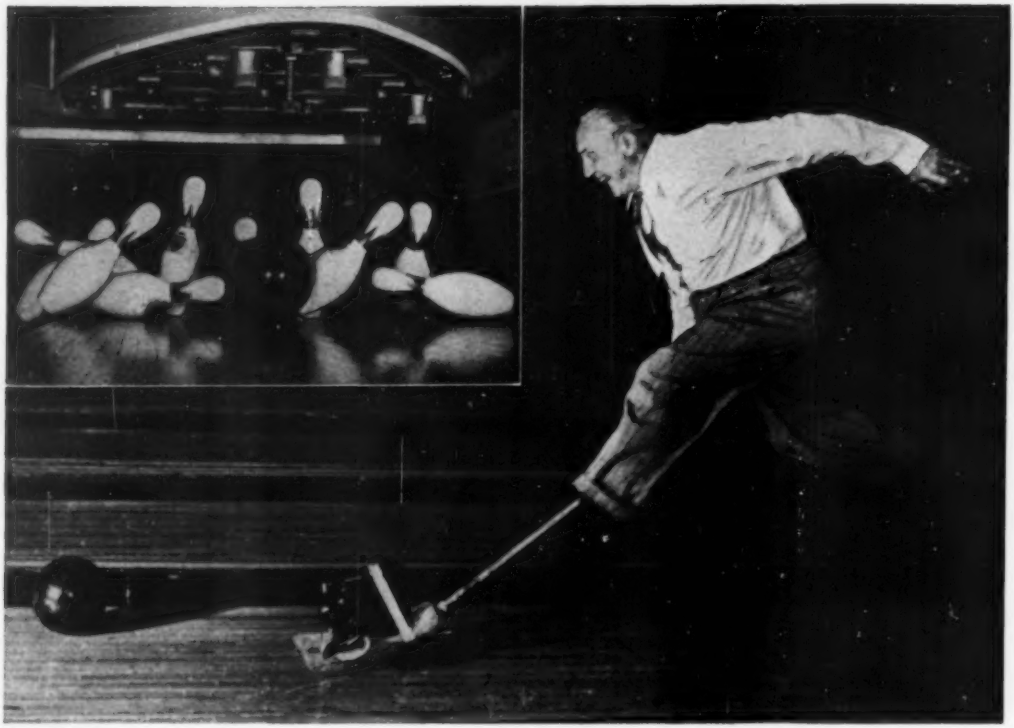


Stagecoach Measures 3". Despite its size, this midget model includes much detail of the picturesque stagecoaches that once thundered along the trails of the old West. Built entirely by hand, it is the work of C. W. Frey, of Pittsburgh, who scaled it down from plans that appeared in POPULAR SCIENCE. It has a wheelbase of 1¼" and other dimensions are scaled accordingly.



Cabinets Faced with Molding. Two unusual radio cabinets built by Douglas Bates, of Philadelphia, are faced with 1½" half-round molding. Coated with ivory enamel, both harmonize well with modern furniture.

In the one at the left, the molding is assembled on two doors that have a curved framework, and these swing open for operation of the radio. Half-round fluting also was used for the end of the chairside model, and composition board for the side. In each case a top was cut from an old radio cabinet and the walnut finish retained. The toe recess of the semicircular model consists of several layers of stock built up to 3" thickness.



Camera on Broom Shoots a Strike

NEWS photographers do a lot of ingenious and strange things to get photographs that are a little out of the ordinary, and here's a case in point.

An editor for News of the Day newsreel figured that something different might result if a movie camera could be made to chase a bowling ball down an alley, showing the ball in flight and the knockdown of the pins. The assignment was turned over to cameraman Norman Alley.

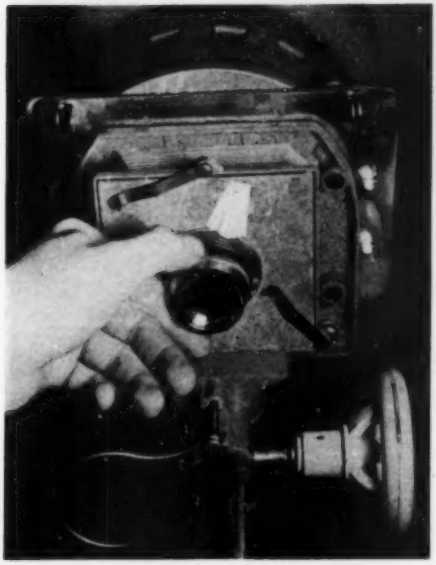
He solved the problem by setting up his lights, taping the camera to an ordinary broom, and then chasing the ball down the alley in his socks. The inset shows the strike he pictured. A still camera might be employed in the same way for single shots by tripping the shutter with a cord.

Light Streaks Show Night Activity at Airport

TIME exposures made at night may frequently be given additional interest by recording the movements of passing vehicles as streaks of light.

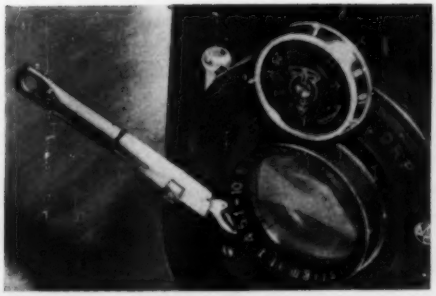
Here's a striking example of such a photograph. It represents a 30-second passage of time at LaGuardia Field in New York City. Made with a 4″ by 5″ camera at f/8, the photo shows the path of light made by a plane rising from the field beyond the hangars, as well as rows of light left by cars entering and departing from the parking area.

PHOTO IDEAS AND EQUIPMENT



Light Shows Diaphragm Mark. So that you can see to set the aperture of your enlarger after focusing, drill a ¼" hole in the lens board close to the index mark. Then cover the hole with a slanting cardboard or metal hood to direct the light from the enlarger toward the diaphragm figures on the lens barrel. Be careful that no light leaks downward.—*Hank Stockert, Chicago.*

Keep Film Inventory. How much cut film remains in a box often is a question. Keep inventory by recording sheets removed.—*Glenn A. Wagner, Delmar, N. Y.*

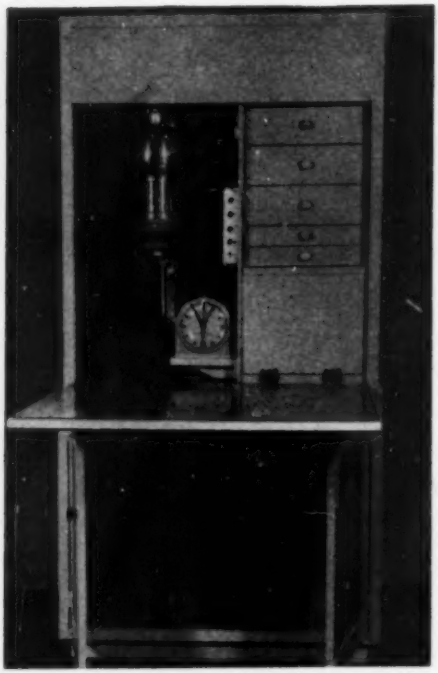


Lever Operates Shutter. A short length of small aluminum tubing, flattened at one end and then attached to the shutter release, will give more sensitive control of the release. It may be fastened by drilling a hole through both tubing and release and inserting a screw. For remote-control shots with a string, drill a hole in the flattened end of a second piece of tubing and thread a headless bolt into the other end. This can then be temporarily inserted in the permanent lever.—*Richard F. Trump, Ames, Iowa.*

Test Your Flash. Each time you mount a solenoid-type flash gun on a roll-film camera, cap the lens and fire the shutter with the synchronizer. This simple test will save film in case you have a poor connection.—*A. H. Selkowitz, University, Ala.*

Tripod Fits in Pocket. A new tripod manufactured by the Kinnard Company, of Milwaukee, Wis., has legs formed of a spiral coil of stainless steel. When extended, the legs are said to be capable of supporting even a heavy camera. With the legs telescoped, the tripod is so compact that it can be easily slipped into a pocket.

Ready for work, the enlarger, safelight, and white light are all pulled out of the cabinet.



Storage space is provided in the base of the cabinet for chemicals, trays, and other items.

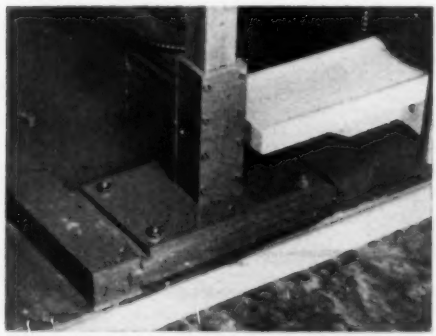
Darkroom Built in a Chest

By A. H. Honest

HERE'S a solution to the space problem of those amateur photographers who must work in the kitchen or bathroom because of lack of a darkroom. All necessary equipment and supplies may be stored in the cabinet and you can get to work without loss of time.

Built around the enlarger, the chest is 20″ deep, 36″ wide, and 72″ high, but these dimensions may have to be altered to suit

Grooved slides support a safelight and white light. A panel 8″ wide encloses this section.



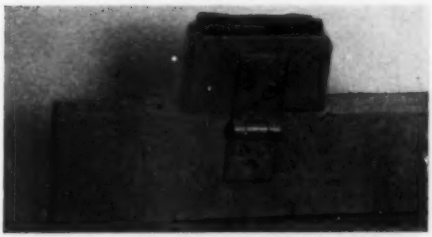
The enlarger likewise is mounted on a grooved slide. A timer rests on the narrow shelf at right.

your enlarger. In this case, the section above the hinged work table measures 38″, but this dimension might well be extended to take a taller enlarger. Except for ¼″ plywood in the door panels, ¾″ stock was used.

Five small drawers in the upper section accommodate small accessories. Below these is a paper safe—five shallow drawers with a spring-hinged panel in front. A switch panel is located on the upright partition.

A work table is provided by lowering the upper panel until it rests on hinged blocks on the two opened bottom doors. The remaining 8″ wide board at the top of the chest is removed separately. This two-part front was adopted to keep the work table from being too deep to reach across when lowered. The narrow panel is held in place by a few clips.

Removed from its baseboard, the enlarger post was rigidly mounted on a grooved-slide arrangement. The sliding member of this is made of 1″ stock and the track is of 1¼″ stock. Similar slides built from ¾″ material are used at the top of the cabinet for the two lights. Linoleum cemented to the table makes a good working surface.



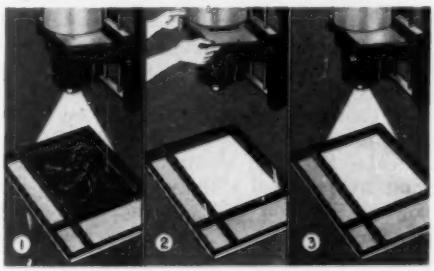
A hinged block atop each door holds the work table level. Note felt cushion on the block.

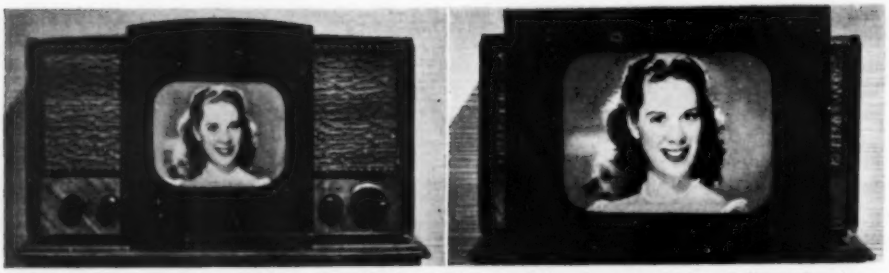
Flashing a Print Reduces Excessive Contrast

ALTHOUGH you may not often need to flash a print, this simple technique can be a great help sometimes. The rainy night scene shown here is a good example.

The straight print at the left displays the extreme contrast characteristic of night scenes in the city. The one at the right, made in the same way except for flashing, shows a reduction of light flare without loss of detail.

When you find a negative that needs flashing, make an enlargement in the usual way (1), allowing normal exposure for the negative. Then remove the negative (2) without disturbing the easel and return the carrier to position. Next (3) give the paper a very brief flash of the enlarger light. Develop the print in the customary way.

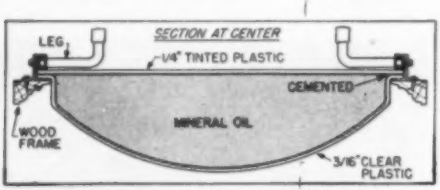




Left above, screen image of a 10" television tube; at right, same image seen through a lens.

Lenses Magnify Television Images

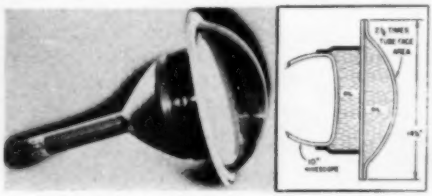
TAKING advantage of the optical properties of clear plastic and mineral oil, outsize magnifying lenses afford bigger television images from modest screens. Units made thus would be prohibitively costly if made of glass. The Tele-Vue-Lens Ⓣ shown in front of a 10" receiver at right above magnifies image area about three times. It's offered by Walco Sales Co., East Orange, N. J., at $60.



Tinted plastic is used as the rear sheet of this magnifier to reduce any tendency toward glare.

Blue-tinted plastic is used for the rear element of the Vue-Scope Ⓣ, made by Celomat Corporation of New York, to reduce glare. Shown at the left, it is priced at $20 to $60, depending on the model.

Both these lenses are attached by sliding brackets under the receiver. The All-Vue Ⓣ, made by Liquid Lens Corp. of Flushing, N. Y., fastens on the tube. It magnifies 2½ times and permits wide-angle viewing.



Applied right to the tube, this two-part lens focuses on the screen coating, not the glass front.

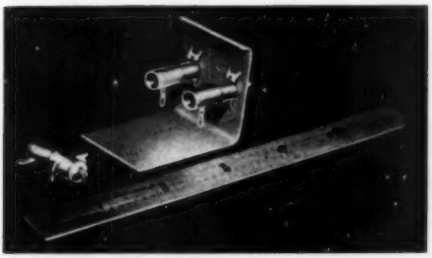
Felt Pads Increase Friction Between Records

MUSICAL "wows"—sour notes caused by speed variations in records—sometimes come from slippage between warped records stacked up on an automatic changer. To correct this, friction disks manufactured by the Thomson Traction Mat Co., New York, may be affixed to the record labels. They're circular felt pads about 2¾" in diameter, and are provided with cutouts so that the record title can still be read. Priced at about 20 for $1, the disks come with an adhesive coating for attachment.

NEWS IN ELECTRONICS

Red Tubes Give Extra Service. A new line of "Special Red Tubes" Ⓣ recently announced by RCA is intended for those electronic-tube applications where long life, ruggedness, dependability, and uniformity are of prime importance. First members of the series are types 5691, 5692, and 5693, roughly equivalent to the 6SL7, 6SN7, and 6SJ7 respectively. When used within specified ratings, these tubes are guaranteed for a minimum of 10,000 hours or two years of operation.

Director Radios His Orders. Tiny single-station receivers (directly above) have been built by sound technicians at Paramount Pictures to help movie actors and directors get together. A transmitter in the studio sends messages up to 300′, with the director speaking into a microphone instead of shouting into a megaphone. Director Mitchell Leisen, upper left, wears his set around his neck, but actress Andrea King has hers worked into her hairdo. The set is completely concealed, and a flesh-colored plastic tube carries the sound to an invisible hearing-aid phone in her ear.



Trimmers Tuned by Plungers. The capacity of these tubular trimmer condensers, manufactured by the Erie Resistor Corporation, Erie, Pa., can be varied by changing the position of the plunger inside the plastic tube. Relative slowness of capacity change facilitates accurate alignment. Range is 1 to 8 mmf.

Volume Control Has Clutch. The built-in clutch on this new Clarostat potentiometer allows it to be turned beyond normal end limits without damage to the shaft or contacts. Designed originally for the motor-driven controls on some television and auto sets, the unit is now available to experimenters.

How to Buy Radio Parts

By Frank Tobin

Knowing what to buy and why is the first step to successful shopping, and the key to building electronic gadgets that work.

SHOULD you ask a radio-parts salesman for a "double-o-one-mike condenser," he could put out a counterful of parts—all different, yet all .001-mfd. capacitors. "Which do you want?" he might ask. "Paper, mica, or ceramic—and what voltage and tolerance?"

If your first impulse is to say that it makes no difference so long as the capacity is right, you've probably never seen the wax melt out of a paper condenser used where a mica should have been. Sometimes, to be sure, identically rated parts may be used interchangeably. But don't overlook the many cases where an improper part may cause a short, burnout, or open circuit, or simply become defective in a hurry.

Some of the things that are worth knowing about condensers, coils, resistors, output transformers, and tubes are dealt with in this article. You may find them helpful next time you shop for radio parts.

Condensers—Fixed and Variable

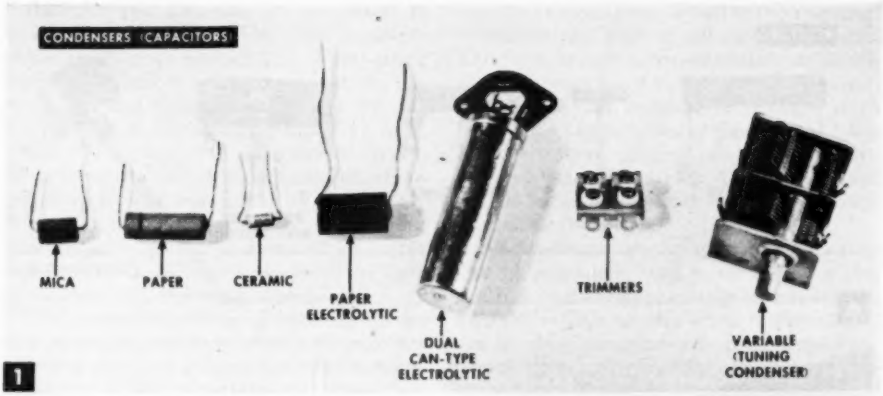
Mica condensers (Fig. 1) are easily recognized by their molded-plastic cases. They are commonly used in by-pass and coupling circuits and as grid condensers in grid-leak detectors. Their working-voltage rating is generally about 500 volts DC but the cases are rarely marked. Mica condensers are used mostly at high frequencies, and therefore capacities are low, ranging from about 50 mmf. to 6,000 mmf. (.006 mfd.). You'll find micas in demand wherever low capacities with low loss at high frequencies are required.

Incidentally, in case condenser arithmetic has you stumped, the basic unit of capacity is the *farad*. As radio components go, this unit is enormous, so it's divided by a million. This gives the *microfarad* (mfd.) and can be expressed as .000001 farad, (one millionth farad) but would normally be written 1 mfd. Even that's big in radio work, so the microfarad is further divided by a million to give the *micromicrofarad* (mmf.) which can be written .000001 mfd. or, more simply, 1 mmf. To translate mfd. to mmf., simply move the decimal six places to the right (in effect, multiply by a million). Thus .0001 mfd. is the same as 100 mmf., and .005 mfd. becomes 5000 mmf.

One of the war-developed ceramic capacitors will often do when specifications call for mica. Ceramics have high stability and compactness; they come in the form of small disks or tiny cylinders resembling fixed resistors (Fig. 1). They are also primarily for use in radio-frequency (RF) circuits.

Paper condensers can be found in every stage of a modern receiver. They have such varied functions as by-passing stray signal voltages, coupling two stages, bass boosting (in tone-control circuits), and filtering in certain rectifier applications.

Working voltages are usually indicated for paper condensers, and it is important that the rating be adequate. When in doubt always take a larger voltage. In AC-DC or



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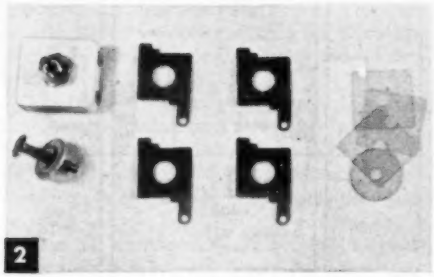

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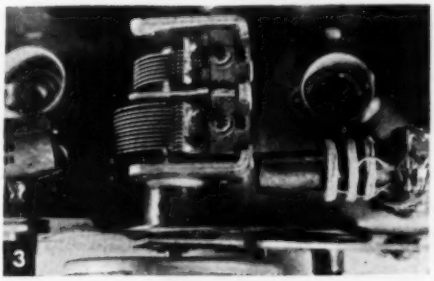

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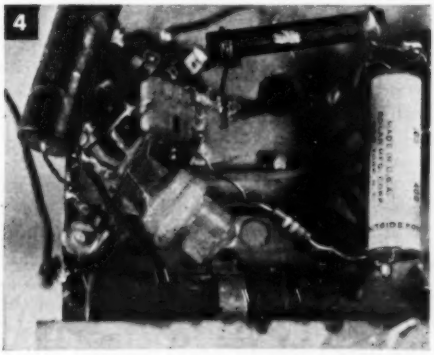
battery-operated receivers a condenser rated at 400 volts allows a safe margin. You might get by with these even in an AC set or amplifier that delivers 250 to 350 volts of B plus, but a few pennies more can buy greater safety in the form of 600-volt condensers. Sometimes heat generated by tubes may melt the wax in which a condenser is sealed. Where this seems likely, try to get capacitors sealed in plastic.

There is still another type of fixed condenser that crops up in practically every piece of radio or electronic equipment—the electrolytic. This is used in all filter circuits and in many special applications. Electrolytic condensers come in aluminum cans or cardboard containers. In order to save space (and cost), two or more units are often put in one container with separate leads brought out. A single can containing two units is called a dual electrolytic; multiple electrolytics with up to four sections are common. Polarity must be observed for electrolytics, so make sure the leads are color-coded or



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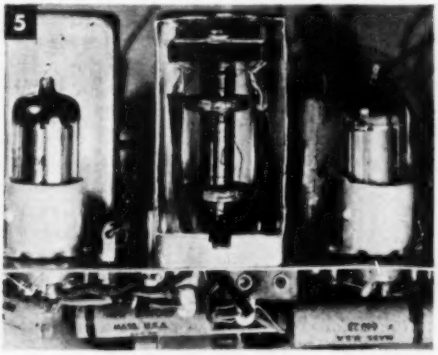

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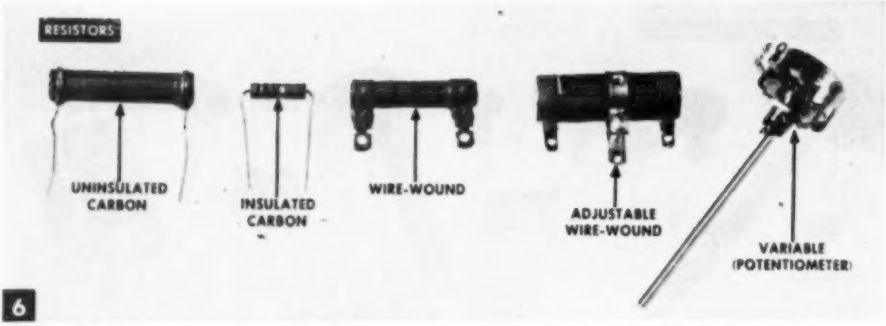

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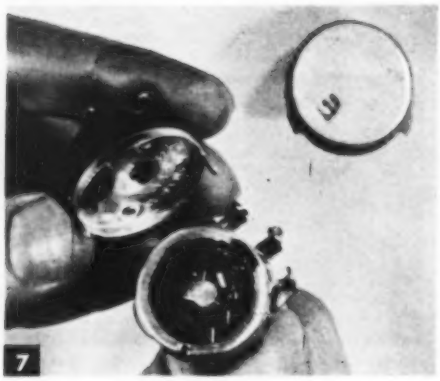

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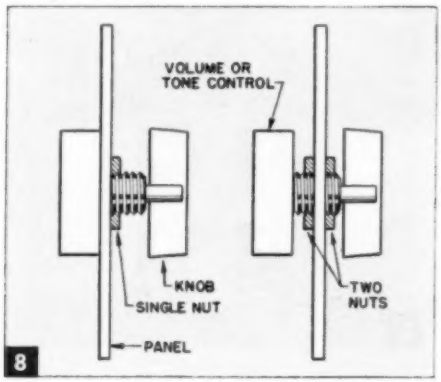

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otherwise marked. Standard codes use red for the positive and black for the negative terminals.

Fixed condensers sometimes vary from rated value by as much as 20 percent plus or minus. Except for test equipment or the like you can usually allow an extra margin of up to 20 percent when you can't find a condenser of the right size. If the parts list calls for .005 mfd., you can get by with .006 or .004 mfd. But for very exacting equipment it is frequently wise to pay more for condensers guaranteed within 5 percent of stated capacity.

The variable condensers used for tuning short-wave or broadcast receivers are usually .00014 mfd. (140 mmf.) or .000365 mfd. (365 mmf.). They're available either as single units or ganged into two or three sections. The type to buy depends on the number of tuned circuits in the set. Ganging of two condensers of unequal size is common in superhets to tune the antenna and the oscillator circuits to different frequencies.

Experimenters almost always find it wise to purchase variable condensers with built-in trimmers. These are sandwiches of metal and mica (Fig. 2). A setscrew squeezes the metal plates more tightly when you have to increase capacity, or relieves the pressure to reduce capacity. Fig. 3 shows trimmers mounted directly above the variable plates.

Trimmers are built into most IF transformers to enable you to make minor adjustments. They also come separately for use in coupling an antenna to an antenna coil, as padders in oscillator circuits, and even as tuning condensers in midget receivers.

Coils

Coils constitute another large and often bewildering category to the man who sets out to buy radio parts. Under this head you will find plug-in, antenna, RF, oscillator, and IF transformer coils. Some are shielded, some aren't.

Plug-in coils, found in simple crystal and regenerative receivers, are generally sold in matched sets to cover broadcast and short-wave bands. In most cases the tuning condenser is of 140-mmf. capacity. Four-prong coils are used when the circuit calls for two windings, while six-prong coils are needed for three windings.

Antenna and RF coils are employed in small TRF receivers. They are available either shielded or unshielded. When using unshielded coils, it is best to mount the antenna coil above the chassis and the RF coil underneath so the chassis will serve as a shield. Wherever it is necessary to mount all coils on one side of the chassis, or where there's more than one tuned RF stage, only shielded units should be used. In buying receiver coils, ask for a matched set. This will assure accurate ganging between coils as well as with the condensers.

Most superheterodyne circuits call for an antenna coil, and they always require an oscillator coil, and at least two intermediate-frequency (IF) transformers. Shielding problems are the same as in the TRF set. In the lower foreground of Fig. 4 an unshielded oscillator coil is mounted underneath the chassis.

The transformers used to couple IF stages are basically coils tuned to a fixed frequency —in broadcast receivers 456 kc. They are in aluminum cans (Fig. 5 shows one cut away) with lugs, clips, or feet by which they can be mounted.

Some IF transformers are brought to peak frequency by trimmers, and some by adjusting an iron core. The latter respond over a much broader tuning range and are therefore easier to align without a signal generator.

One final point to bear in mind when buying coils: If you are building a receiver with only a single stage of RF or IF, you need maximum amplification in each stage. You will get this plus greater selectivity by using coils with iron cores.

Fixed and Variable Resistors

You'd have to look hard for an electronic circuit that doesn't use a fixed or variable resistor of some kind. Fixed carbon resistors constitute the bulk of all resistance units. They are inexpensive, reasonably accurate, and come in a large variety of sizes and ratings. Some are encased in plastic, which makes them impervious to moisture and less likely to short against other components. Uninsulated resistors (Fig. 6) dissipate heat a little more readily but shouldn't be used in cramped quarters.

All fixed resistors are rated in *ohms* (the unit of resistance) and *watts* (current rating). As with voltage ratings in condensers, a larger wattage is safer when there's doubt.

For AC-DC receivers and amplifiers, ½-watt units are generally adequate in the control-grid circuits of amplifier tubes. Plate and screen circuits should get 1-watt resistors, and cathode and filter circuits 2 watts or more. Battery-operated equipment can generally get by with ratings half as large.

Wire-wound resistors are employed where current drain is high and where stability and accuracy are paramount. On adjustable wire-wound resistors part of the winding is left bare so that a movable metal band can tap off any resistance between zero and the maximum.

Variable resistors, now found chiefly in the form of potentiometers, have a fixed carbon or wire-wound element and a moving contact turned by a shaft. If you want resistance to increase evenly in proportion to shaft movement, specify a linear-taper pot. Because of tube characteristics, nonlinear pots usually give more gradual control over volume, tone, and bias. In logarithmic pots, usually used for tone and volume controls, resistance increases at a definite but uneven rate. In end-tapered pots, used for varying tube bias, resistance "thins out" at one end.

For the convenience of radio builders, the

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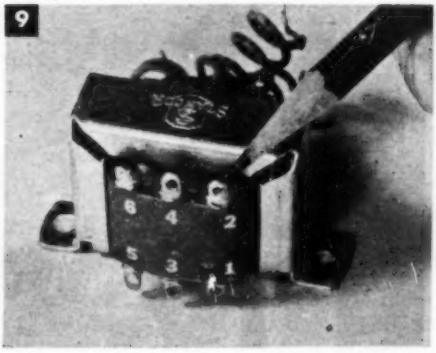

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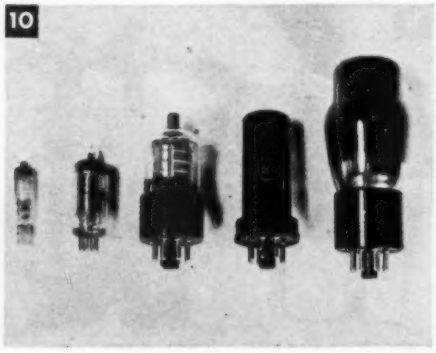

makers of potentiometers provide switches that can be slipped onto the back of the unit (Fig. 7). The switch is actuated by the first few degrees of shaft turn.

A potentiometer is usually fastened to a panel by means of a gripping nut screwed on a threaded shaft. Since there is a good deal of variation in shaft nuts, you can often do yourself a favor by purchasing an extra one at the time you buy the potentiometer. With two nuts you can exactly regulate the projection of the shaft in front of the panel as shown in Fig. 8.

Output Transformers

In purchasing an output transformer for a small set, it is best to look for the universal type. Taps on the secondary winding of the transformer (Fig. 9) allow matching of any tube impedance from 1,500 to 20,000 ohms to any voice-coil impedance from .1 to 24 ohms. These figures vary somewhat with different makes.

Impedance matching is probably the leading consideration in the selection of an output transformer, but there is one other that must never be overlooked. If the transformer can't handle all the plate current that will be delivered to it, it cannot transfer that power to the speaker. Output transformers are rated in watts. For most battery and small AC-DC receivers, 4 to 5 watts is suitable; for AC receivers and high-powered audio amplifiers you will usually want a transformer rated at 8 watts or more.

Tubes and Pilot Lights

Some people feel that radio tubes offer the largest variety of radio components. Several catalogs list upward of 400 types. This, however, need rarely worry the builder who works from a parts list. The specifications always designate tubes by numbers.

One puzzling element is the lettering that follows the tube number. A metal 6K7, for example, has the same electrical characteristics as the glass-dome 6K7-G or the bantam 6K7-GT (the latter is sometimes listed as GT/G). The only differences are in their physical dimensions (Fig. 10) and in the method of shielding. The first of these tubes is encased in metal, the other two in glass envelopes of different sizes (G being considerably larger than the GT). The 6K7 requires no separate shielding, while the others must be covered with a metal shield (Fig. 11) to suppress undesirable coupling. Only tubes used in the high-frequency circuits—RF, converter, IF, and sometimes detector stages—need shielding; others such as power output tubes and rectifiers don't require it. Fig. 10 shows the most common types of receiving tubes, being, from left to right, subminiature, miniature, bantam (GT), metal, and glass dome (G).

Sometimes you want to duplicate a particular circuit in a smaller size. This is becoming increasingly possible with miniature components. For example, the 50L6 beam-power amplifier can be replaced with a 50B5 miniature.

Dial pilot bulbs become critical in AC-DC sets, because they're in series with the tubes and must match them in current rating, since current is equal in all parts of a series circuit. The bulb ratings are marked by a colored glass bead in the bulb. For example, a set using tubes with heaters drawing .15 amp at 6.3 volts calls for a brown-bead pilot bulb. A white bead means .5 amp. at 2.5 volts, a blue .3 amp. at 6 to 8 volts, and a pink one .06 amp. at 2 volts. All types come with both bayonet and screw bases to suit the two socket types (Fig. 12). END

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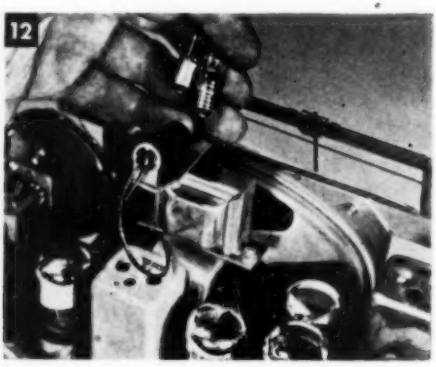
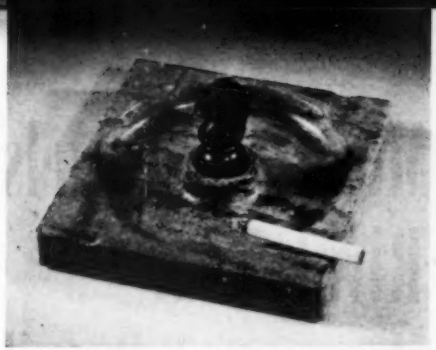




Meant for men, this ashtray is a good smoking companion, doesn't call for frequent emptying.

Steatite base can be turned by gluing to wood with cellulose cement for faceplate mounting.

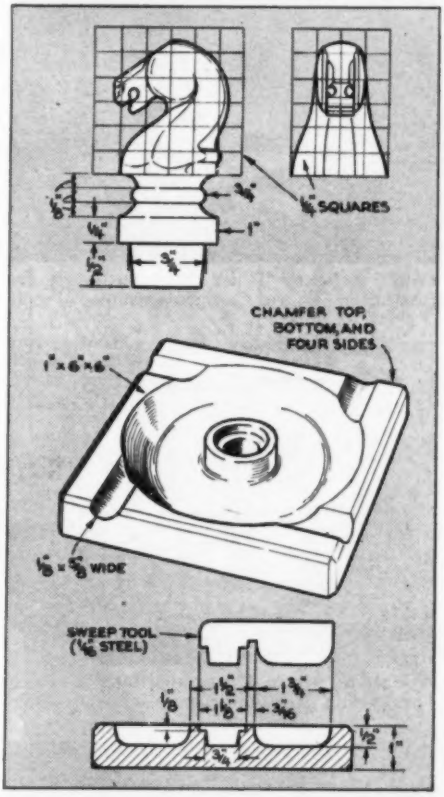
Ashtray Figure Snuffs Out Butts

If you don't like light, undersized ashtrays, make yourself this man-sized one. Massive enough to stay where you want it, it has a big capacity. The figure, borrowed from the traditional chess knight, can be taken from its socket to crush smoldering butts.

The original shown was made of Sculpstone Ⓣ, a form of steatite sold for craftwork. It's pleasingly heavy, available in various colors, and so soft it can be worked with hand tools. You could, of course, cast the project of Keene cement, model it in clay and fire it, or make the base of wood with a metal liner, and the figure of plastic.

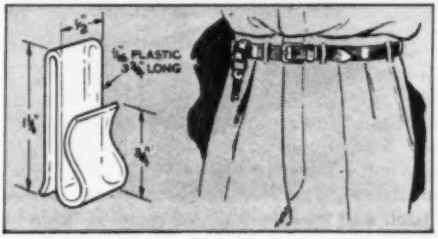
To make it of Sculpstone, bore a ⅝″ hole in the center of the base. With a knife or scraper, taper this to ¾″. File a sweep tool as shown and work it around from the center hole to form the concave recess. File the cigarette rests, chamfer the edges, smooth with fine steel wool, and apply oil to bring out the tone.

The base of the figure can be turned, or shaped by round carving. Transfer the head pattern to two sides of the block, saw to outline, and carve. The stone can be coated with a plastic hardener to resist abrasion.



Key-Ring Clip Bent of Plastic

Handsome but not conspicuous, this key-ring holder slips on your belt and has a secure hook for the ring. Polish the cut edges of a 3¾″ strip of 1/16″ sheet plastic, heat until soft, and shape with gloved hands. If you have a strip heater, warm ⅜″ for the close bend and a 1″ section for the hook.—*Frank Shore, Manhattan, N. Y.*



Chief tools are pencil, straightedge, knife, paintbrush. Above, Gardner assembles a wall.

Miniature Models Rival Real Houses for Detail

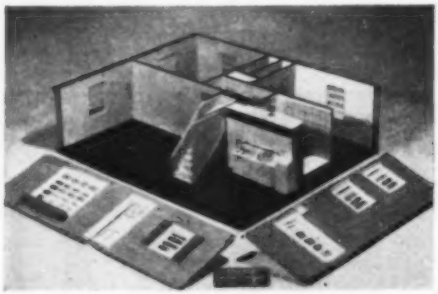
HERE'S an example of a hobby that grew into a profitable spare-time business. Long interested in architecture and model-making, George S. Gardner, of Lynbrook, N. Y., found many architects and builders anxious to buy exact scale models of the homes they planned to erect.

His models are made of illustration board, wood being used only for inside bracing and occasionally for a chimney. Such effects as clapboards, brick, and field stone are achieved by painting with poster colors.

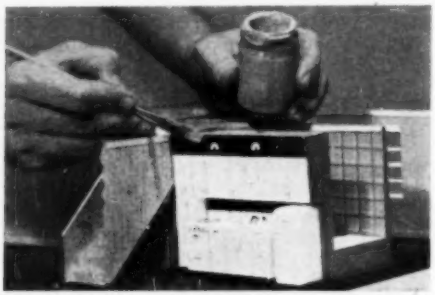
Photos by R. S. Hull

A scale of ½" to 1' was used for this model. Overlapping strips of paper simulate siding.

The roof lifts off so prospective buyers can see the layout of rooms and interior fittings.

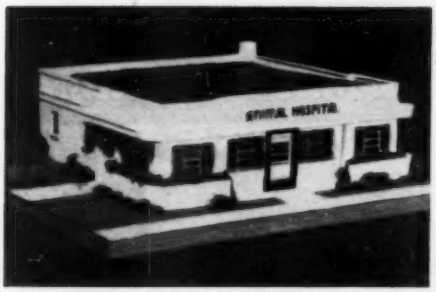


Each wall is made as a unit, complete down to paint, and the whole then cemented together.



Hand painting with poster colors gives varied effects. This paint is flat and dries quickly.

Relative size of this trim model is shown by the cigarettes. The scale here was ⅛" to 1'.

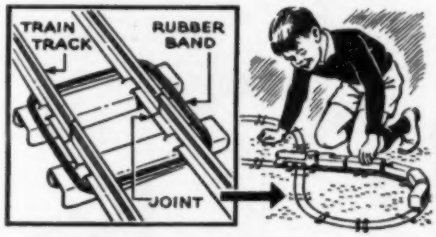


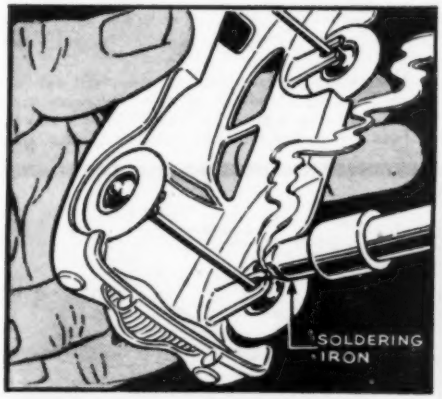
Many builders use models of this kind to show clients what the completed job will look like.

Finished models are mounted on a green board, walks and drives are added, and the plot landscaped with green sponge rubber, cut up in a meat grinder and tipped with bright colors in spots to simulate flowers. Norwegian moss dyed green is employed for shrubs and trees. Interior fittings like refrigerators and bathtubs are cast of plaster.

Rubber Bands Hold Toy Track

If the sections of track for a toy train develop a tendency to pull apart, a rubber band looped over the ties and under the rails at each joint will provide a quick and simple remedy. As seen in the drawing, the rubber band does not interfere with the train or raise the track from the floor, and there is nothing to come loose or rattle.





Heat Repairs Plastic Toys

In some of the toy automobiles and other wheeled vehicles made largely of plastic, the axles frequently pull out of their notches under the toy. This can be prevented by heating the tips of the axle housing with a hot soldering iron and bending them together, sealing in the axle.—*R. M. Woodbury, Atkinson, N. H.*

Paints Mixed in Egg Carton

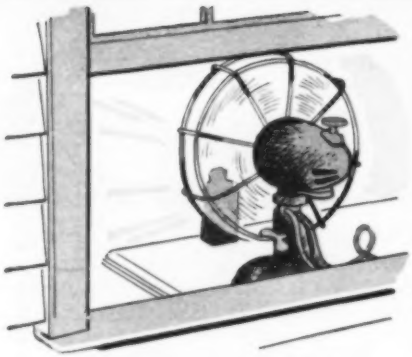
One of the new plastic egg cartons provides an efficient means of mixing water colors. The pockets are deep enough so you can prepare paint for an extensive job, and the container is easily cleaned after use. With various colors right at hand, the carton is especially useful for sketching outdoors.—*Will Stoll, Elmhurst, Ill.*

Keeping the Home Shipshape

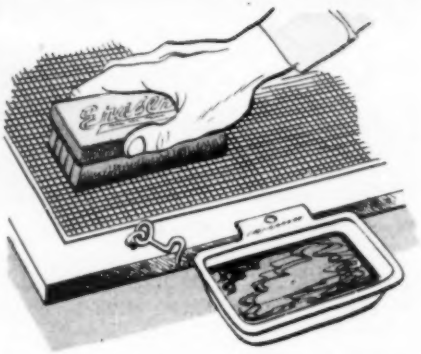
Old salt boxes, the kind with a metal pouring spout in the top, are fine for dry food supplies when camping. Shellac the outside to make them damp-proof, and label the contents.

An insulating link, desirable on pull-chains located near water faucets, may be made with a bit of 3/16" o.d. rubber tubing. Secure the ends by lashing them with strong thread.

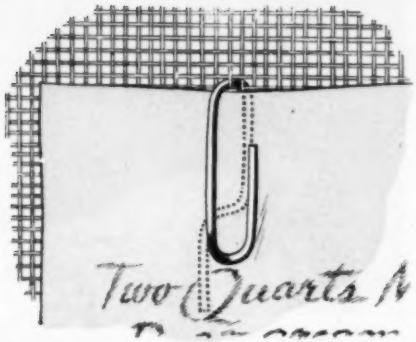
For aiming a hose at just the right spot to soak plants, bushes, or trees, a wire coat hanger forms a good holder. Though it can be bent as needed, it's stiff enough to stay put.



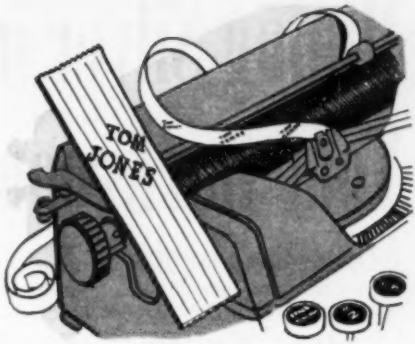
Wick-type air fresheners will do their work much faster if placed in the air stream of an electric fan. If air is drawn in from an open window, the process is still more rapid.



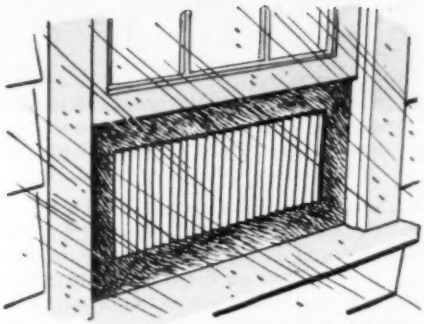
Equal parts of spar varnish and turpentine, well mixed, will give protection to window screens that'll often outlast paint. Apply with a well-cleaned old blackboard eraser.



To leave a note on a screen door, bend down the inner prong of a paper clip and insert it through the screen from the outside. It will hold a small note even on a windy day.



Name tapes for sewing in clothes can be made by writing on cloth tape with a typewriter. With a well-inked ribbon, they'll withstand many washings. Feed the tape in diagonally.



Fresh air even in driving rain can be had by closing a window on an old wooden shutter cut to fit in horizontally. Put it in with the slats sloping against the wind direction.

If you don't like white smears on the edges of sport-shoe soles, make a cardboard mask for use when applying the whiting. Turn it over to fit the other shoe of the pair.

A cloth shoe bag forms a convenient place to set out the sorted mail at a summer camp or rooming house. Label each pocket with a name and nail up the bag in a hall or on a porch.

Mining Silver in Your Darkroom

A "slinging wire" supports a toothpick holder in some used photo hypo while it is silverplated.

POURED down the drain by most amateur photographers is a solution that contains as much as 0.7 percent pure silver. Used hypo, which picks up silver from both prints and films, makes a fine experimental plating solution. While you will hardly find it profitable to recover this silver for its intrinsic value—as do large film processors—you can still use it to replate many small articles made of copper or brass.

The cost of silverplating with old hypo is almost nil, because for power you can use worn cells from your flashlight or flash gun. You probably replace synchronizer cells long before they're exhausted (you should, anyway).

Your first step is to neutralize the normal acidity of old hypo with a small amount of sodium hydroxide (lye) or sodium carbonate. Every trace of tarnish must be removed from the work, and it should be finally cleaned with a soapless household detergent to remove all traces of grease. Suspend the work in the neutralized hypo with a fine wire, which should be connected to the negative side (the casing) of a 1½-volt cell. A clean carbon rod removed from an old dry cell is connected to the positive (center) contact on the cell, and immersed opposite the work. The solution should be agitated occasionally.

Plating continues until either the cell or

Silver is recovered with a carbon anode and a brass cathode. A clip holds the cell in place.

Polishing and cleaning before plating must be performed carefully to obtain a good final finish.

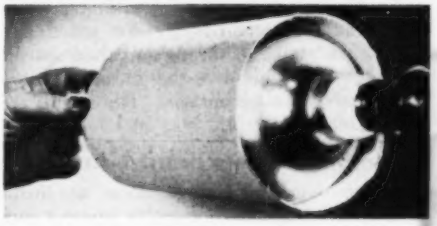
solution is exhausted. To test, dip a clean strip of brass into the solution and touch it to the wire holding the work. If plating is going on, a fine grey coating of silver will shortly appear on the test strip.

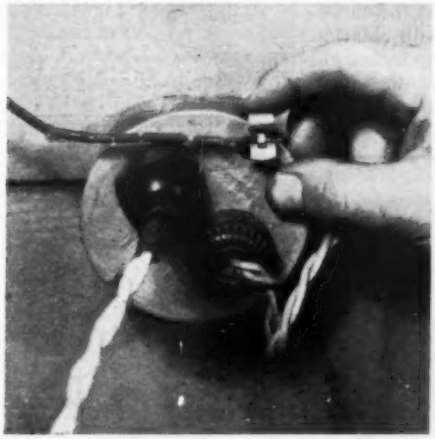
To plate an adherent deposit on brass or other copper alloy, the work should be "quickened," or dipped in a saturated solution of mercury nitrate and distilled water, after cleaning. Without this step, electrochemical action produces a nonadherent coating of silver even with no current. For best results, the work should be highly polished before plating, and repolished afterward with jeweler's rouge.—*Ken Murray, Colon, Mich.*

The back of a spoon bowl, which receives the greatest wear, can be replated with this setup.

Asbestos-Paper Tube Shields Reflector Lamp

ROLLED into a tube and stapled, a piece of asbestos paper makes a fine "snoot" for a reflector-type photo lamp. If you adjust the size of the tube carefully before stapling, it will stay on the bulb without other support. The tube will be found especially useful in side lighting and back lighting, where without it direct light might strike the camera lens.





Outlet Box Serves as Ground

WHEN a ground connection is needed for a radio set or washing machine, it is often convenient to attach a terminal clip to a junction box that's fed through BX cable. The armored cable sheath normally makes a low-resistance connection to ground, and is usually handier than a water pipe.—*D. J. Bachner, Jackson Heights, N. Y.*

Milk-Cap Wire Aids Modelers

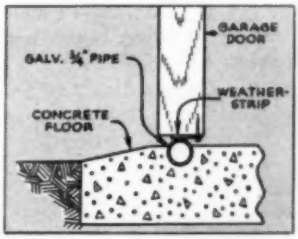
The tinned wire used to hold outer milk-bottle caps has many modelmaking uses. One of them, shown above, is for lashing the steel-wire landing gear of model planes. The wire is soft, readily handled, and solders well without cleaning. Better yet, a steady supply is delivered, free, to your door.—*M. C. Anderson, Globe, Ariz.*

Machine Chops Stalks to Bits, Eases Plowing

Two sets of steel knives whirling at 1,000 r.p.m. in this new cornstalk cutter practically reduce the stalks to shreds and then spread the material evenly over the ground. This is said to have two advantages. The shreds are easily plowed under and won't pull out when harrowed. Corn borers are also mostly chopped up and those that remain don't have enough material to incubate. Silbaugh Mfg. Co., Humboldt, Iowa, makes it.

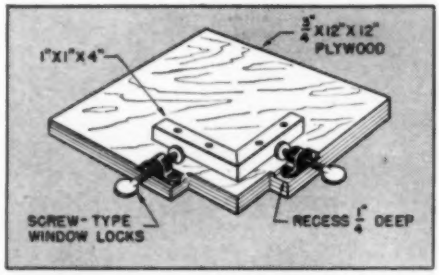
Pipe Seals Overhead Garage Doors

When overhead garage doors are installed, clearance usually is left at the bottom to prevent mud and ice from holding the door off its seat. This source of drafts can be eliminated by installing ¾" galvanized pipe under the entire length of the door, embedding it in concrete with about a third of its diameter above the sill. Weatherstrip tacked to the bottom of the door to fit snugly against the pipe will give a perfect closure.—*Ivan Baxter, Hartland, Wis.*



Coil Gives Short Rod Action of a Long One

Although it's only 21" long, a new casting and trolling rod is said to have the springiness and live action of a conventional full-length rod because of the spring coil incorporated in its length. The shortened casting arc also gives greater accuracy, less backlash, and the reduced length makes it easier to land a fish in the net. For carrying in a tackle box or traveling bag, the rod breaks down to two sections—with an overall length of 14". It is made by Waltco Products, Chicago, and sells for about $6.



Jig Helps Assemble Frames

Faced with the job of making a number of picture frames for my home, I came up with this useful and inexpensive jig. After the miters are cut, the jig is used to clamp two adjacent frame members together while they are being nailed or a spline groove is being sawed. The recesses give clearance. —*Eugene C. Gottman, Brooklyn, N. Y.*

Gadgets for Play Hours

Guide Shows the Way. During daylight, a ten-cent guide distributed by Edward F. Lally, of State Farm, Mass., will give you general compass directions. Consisting of a sheet of clear plastic with an imprinted compass face, it's used by holding your watch level with the hour hand pointing at the sun, placing the South indicator over the hour hand, and then turning it (clockwise in the morning, counterclockwise after noon) until the indicator is half way between the hour hand and 12 o'clock. This is the general direction of south.

One Club Makes All Shots. By quickly made loft adjustments, this golf club is said to be suitable for any shot where you'd normally use anything from a No. 1 to No. 9 niblick. Since it also serves as a putter, you can play an entire game with just the one club. Made by the C. V. Winter Mfg. Co., Chicago, it sells for about $20.

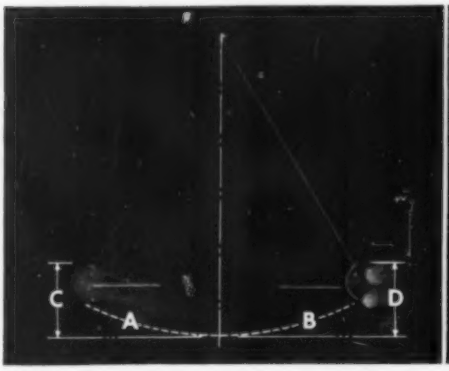
Whistle 'Em Up. If you're fishing with this new bobber, you get double warning of a bite—a tug on the line and a whistle. Designed especially for night fishing or for use when several lines are in the water simultaneously, it's made by W. J. Jamison Co., Chicago.

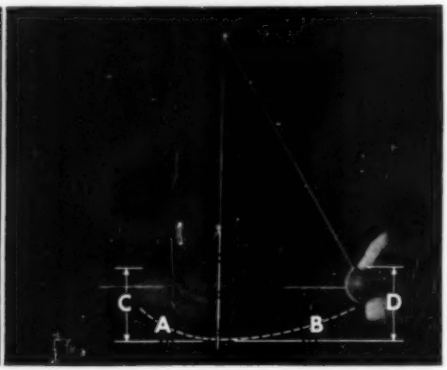
Dirt Kept from Rifle. In this new 15-shot semiautomatic .22-caliber Marlin, there are no cocking-handle slots back of the ejection port to allow entrance of dirt into the action. A lightweight cocking handle (insert) is located on the bolt in the ejection space, well forward on the receiver. The rifle, which is funnel loading with a tubular magazine feed, is 45" long and weighs 6¾ lb.

Experiments Prove You Can't Destroy Energy

BRIEFLY stated, the law of conservation of energy is this: energy is never created and never destroyed; in any situation where no outside energy is received and none is given up, the total available energy never changes, no matter what forms it may take.

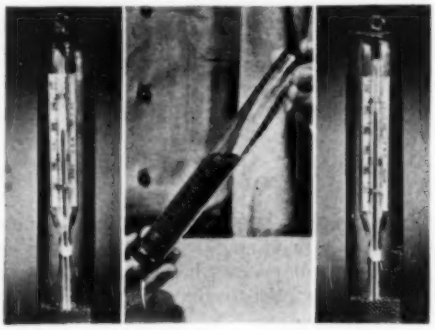
For instance, coal and oxygen unite to give heat energy, the heat energy changes water to steam, the molecular energy of the steam drives a turbine, the mechanical energy of the turbine runs a generator, and electric energy from the generator may then be transformed into light, sound, heat, mechanical, or chemical energy. If the energy lost by friction and escaping heat could be measured and added to all the energy produced by the devices actuated by the generator, you would have a total equaling the energy released by the combustion of the coal. Here are a few examples of how energy is transformed and conserved.

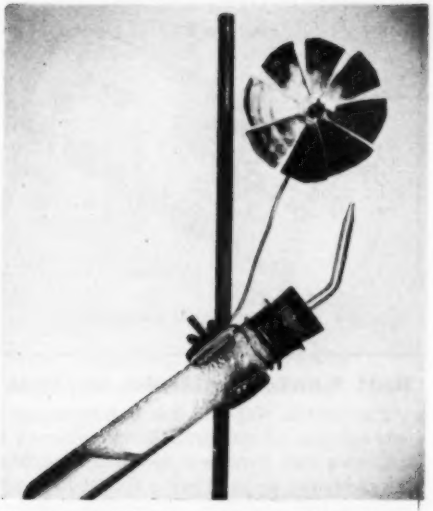


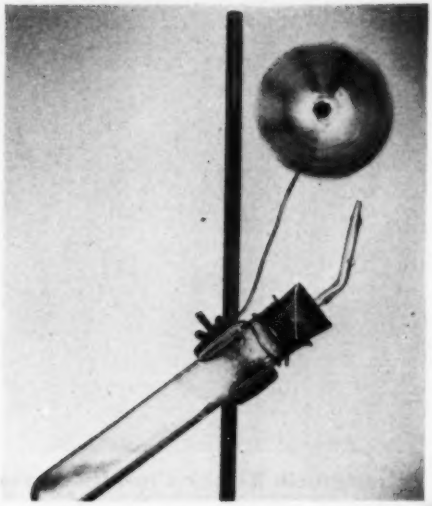


A Pendulum Is One Example. A swinging pendulum demonstrates conservation of mechanical energy. Except for slight friction and air-resistance losses, the bob swings as far beyond the vertical as the point from which it started (at left, A equals B). Significantly, it also rises to the same height, even when a nail on the vertical shortens the swing as at right (C always equals D). At the ends of its travel, the bob has no kinetic (motion) energy but its potential energy is at maximum. As it drops, kinetic energy increases and potential decreases. Beyond the lowest level, this is reversed. Disregarding friction losses, the sum of kinetic and potential energy is always the same.

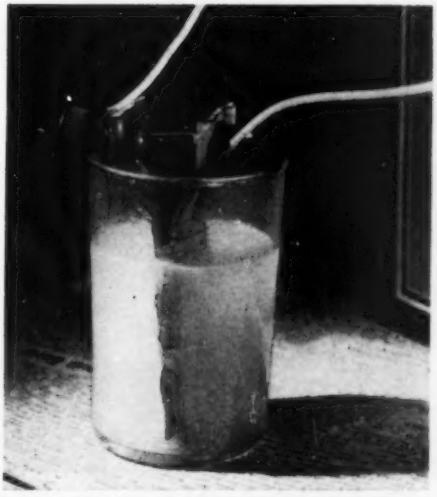
Friction Produces Heat. When solids, liquids, or even gas molecules move over each other, mechanical energy is changed into heat energy. Primitive peoples use this heat of friction to light fires, moderns use it in cigarette lighters. To demonstrate this change of energy forms, put several ounces of lead shot into a large test tube and measure the temperature of the shot. Then stopper the tube and rapidly turn it end for end at least 100 times. If you now take the temperature of the shot you will find it has increased measurably.

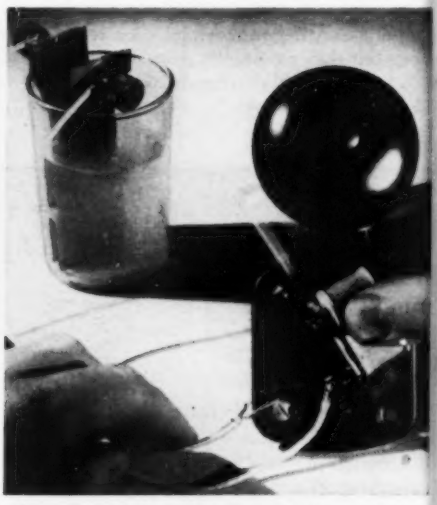






Energy Chain Runs Pinwheel. This simplified version of a steam turbine is an example of how energy may pass through a chain of transformations before finally performing a desired job. When gas is burned under the test tube at the left, chemical energy is released as heat energy. The heat changes the water to steam, and the latter, emerging from the nozzle at high speed, revolves the pinwheel by mechanical energy.

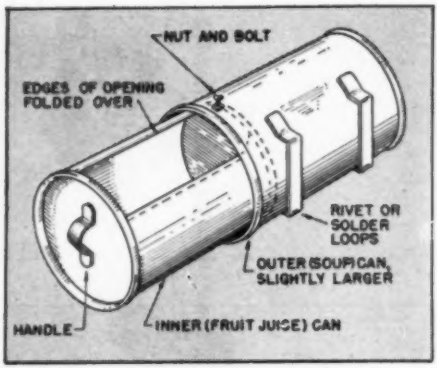




Battery Stores Up Energy. In a battery, electrical energy is stored up as potential chemical energy, but it changes back to electrical energy. You can make a simple storage battery to illustrate this. Fasten a binding post to each of two 1″ by 5″ lead strips, separate the strips with two matchsticks and bind them firmly with rubber bands. Immerse the plates in 4 oz. of water to which you have added 1 oz. of concentrated sulphuric acid, and run wires to four dry cells connected in series, retaining the connection about 10 minutes. Then connect your battery to an electric bell. In the bell, magnetic effects change the electrical energy from the battery into mechanical energy. Part of the mechanical energy then changes into sound and heat.

Electronic Timer Checks Racer

When engineers in the East Pittsburgh plant of Westinghouse took up fizz racing as a noon-hour hobby, they rigged an electronic timer to check the speed of their midget speedsters. Jet-propelled by carbon-dioxide cartridges, the tiny racers hit speeds as high as 131 m.p.h. in little more than a second on a course 160′ long. At first the engineers used four-wheel cars weighing 8 oz., but they eventually discarded the wheels in favor of skids and reduced the weight to less than an ounce.

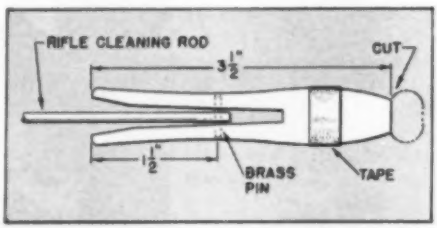


Bait Container Held by Belt

Fishermen will find this bait container a convenience. Two metal loops soldered to the outer can provide a means of attaching the container to your belt. To get bait, you pull out the inner can. A nut and bolt in a hole punched along the edge of the larger can prevent the bait can from falling out. A coat of lacquer will keep it from rusting. —*Ken Murray, Colon, Mich.*

Acid-Core Solder Is Leakproof

A new solder produced by Alpha Metals, Inc., of Brooklyn, N. Y., has the acid flux in paste form. Virtually nonsputtering, this flows only as far back as the solder is melted, eliminating fluxless portions.



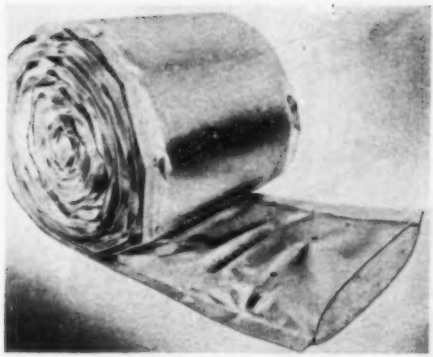
Clothespin Cleans Shotguns

With a common wood clothespin, you can easily adapt a rifle cleaning rod for the same purpose in a shotgun. Saw off the knob, drill holes through the legs, and press a tight-fitting 1/16″ brass pin through the holes and the rifle-rod slot. Be careful that the pin doesn't protrude.

An oil rag around the clothespin makes it fit 16-gauge shotguns, while a little sanding will suit it to 20-gauge guns. For 12-gauge, build up the diameter with a layer of tape. —*Dick Pearson, Los Angeles.*

Mechanic's Light Fits on Head

Designed especially for the use of mechanics, this light leaves both hands free for work and is easily aimed by means of a swivel bracket. Two flashlight dry cells are used, an adjustable elastic band insures a good fit, and rubber pads keep it comfortable. It's made by Justrite Mfg. Co., Chicago, and sells for about $6.

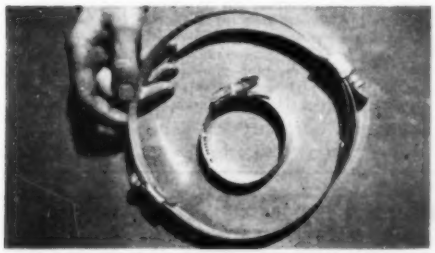


New Insulation Prevents Escape of Radiant Heat

CONSERVATION of radiant heat is a major objective of two home-insulating products recently placed on the market. In each, the insulation has a reflecting outer surface to turn back radiant heat, as well as interior air spaces to reduce heat loss through conduction and convection. Both materials are said to be flame and verminproof.

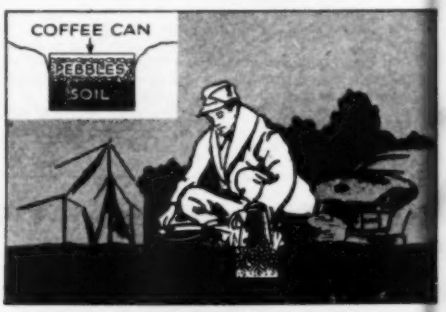
A product of the Gilman Brothers Company, of Gilman, Conn., the roll insulation above consists of two reflective metallic sheets that enclose a fluffy fiber blanket containing millions of dead air spaces. Nailing flanges are provided for easy installation.

Packed flat for shipping, the insulation at the right opens up in accordion fashion for installation. A product of Infra Insulation, Inc., of New York, it has aluminum foil on both faces, with a fiber separating foundation. When installed, as in the drawing, the lower surface is flat.



Two Clamps Make a Big One

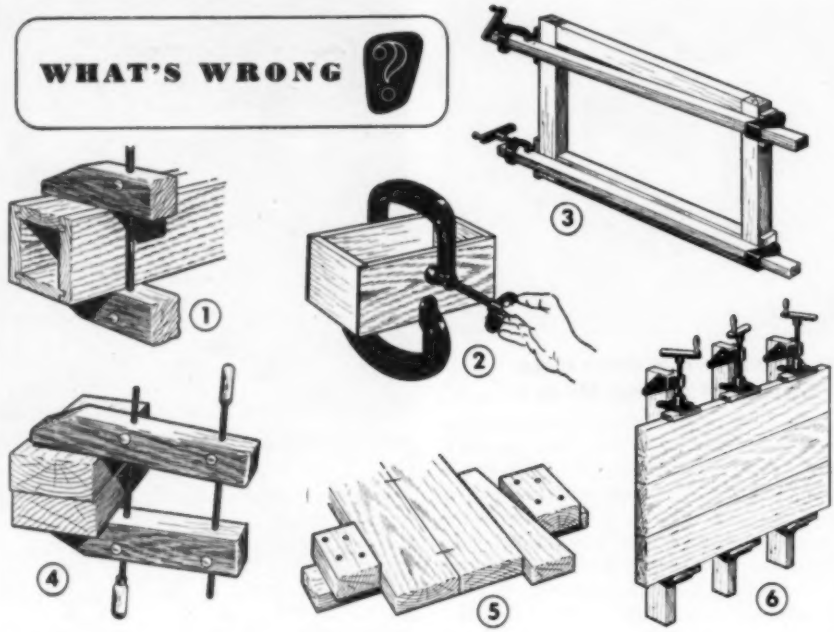
A LARGE clamp for use in such jobs as repairing automobile mufflers, stovepipes, and similar cylindrical objects can be made by screwing together two small clamps of the type shown in this photograph. Since it is possible to buy these in quite a variety of sizes, large clamps of practically any diameter can be produced by making the proper combinations of smaller ones.—*Don G. Pittwood, Moscow, Idaho.*



Campfire Made in Coffee Can

DURING a recent camping trip, I solved the problem of a breakfast fire one rainy morning with a coffee can, dirt, pebbles, and a half pint of gasoline. After the can was half filled with dirt, I filled it with pebbles, poured in the gasoline, put the can in a hole in the ground, and touched a match to it.—*Charles Powell, St. Louis, Mo.*

WHAT'S WRONG ?



CLAMPS are indispensable tools in any woodworking shop, but they are often misused. How many errors can you spot in the drawings above? Answers are printed upside down below.

Answers

1. The clamps should be applied to the other sides of the column. In this position, you would merely squeeze the vertical sides—and the pressure would have no effect on the joints.

2. There are two errors. Blocks should be used between jaws and work, for bare clamps will mar the wood. Also, pressure at the center of the box sides will spring them in, opening the joints. Either apply clamps at both ends or use heavy wood pads to distribute pressure along the sides.

3. Ordinarily the clamps should be parallel to the rails of the frame since any inclination tends to pull the frame out of square. Clamps may be used as seen here, however, to draw the frame true if it tends to be out of square upon assembly.

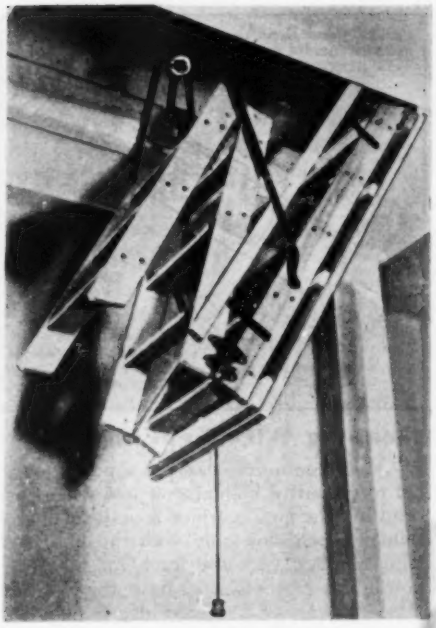
4. The jaws of the hand screw should be parallel, distributing the pressure evenly across the width of the pieces being glued.

5. One wedge used like this will not deliver full pressure. You should either use two opposing wedges or position the clamp block at an angle equalling the taper of the single wedge.

6. Since all the clamps are on one side, the boards may buckle outward. This can be avoided by placing the center clamp opposite the outer two.

Extra Tray Increases Volume Capacity of Scales

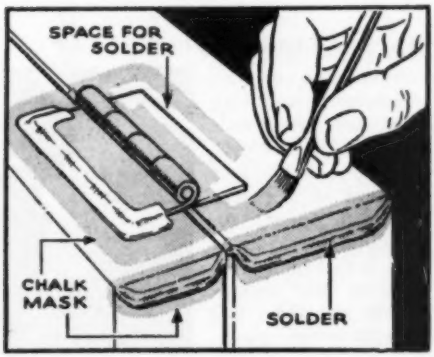
WITH laboratory scales, it is often necessary to weigh several batches of light chemicals to get the required amount. To weigh such chemicals in one batch, make an oversize tray from a tin can and file the edges smooth. Install this in place of the regular tray and balance it with a piece of lead or wire solder. Then when you are weighing chemicals, use this special weight in addition to the regular weights. Keep the special weight with the tray for future use.—*Will Thomas, Kenmore, N. Y.*



Hidden Stairway Folds Up to Fit Small Opening

MADE in three hinged sections, this attic stairway folds up when not in use. Because of this, it requires an opening only 26″ by 54″ and it lies flat on the attic floor after the trapdoor is closed.

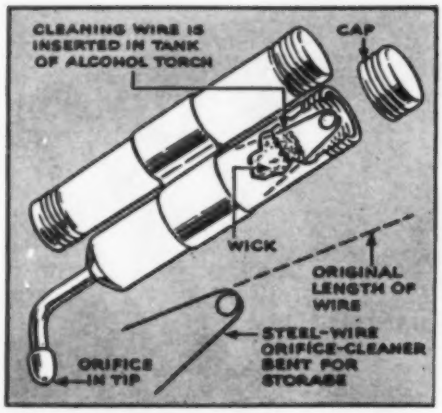
Evenly balanced and actuated by counterweights without springs, the stairway is easily pulled down with a cord, or closed with a gentle upward push. Made of wood, it has brass hinges and aluminum brackets and rocker arms. It's available in two lengths—8′ 9″ and 9′ 9″—from the Precision Parts Corporation, Nashville, Tenn.



Chalk Used as Soldering Mask

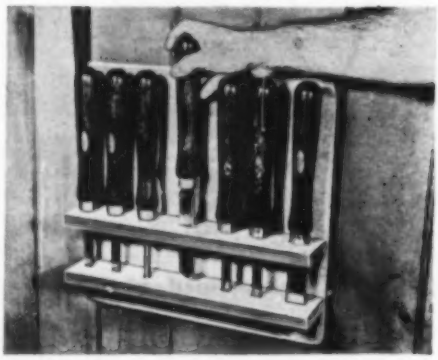
WHILE soldering certain kinds of work—for instance, the hinges and seams of a tin box as illustrated here—you may have noticed that it's difficult to keep solder off areas where you don't want it.

This may be avoided with a chalk mask. Dissolve a stick of chalk in enough water to make a thick paste and apply with a brush around, but not on, the spots you expect to solder. It's best to warm the work first so the paste will dry quickly. When you've finished the job, the chalk may be easily wiped off.—*Andrew Vena, Philadelphia.*



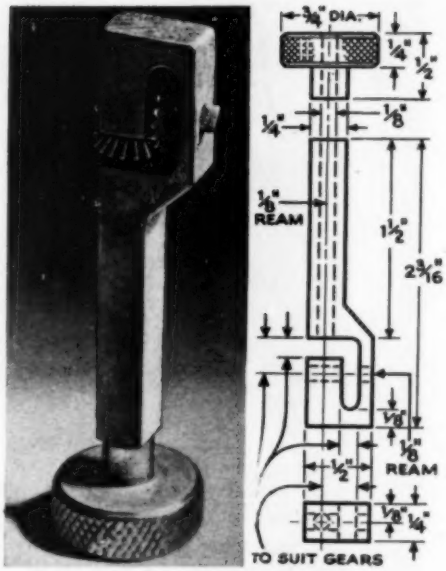
Cleaning Wire Kept in Torch

A CLOGGED nozzle can put a pocket alcohol torch out of commission just when you need it. The nozzle orifice is very small and should be cleaned only with the fine steel wire supplied with the torch for that purpose. The problem is to have this wire on hand. I've found it a good idea to bend the straight wire like a hairpin and stick it into the wicking of the small tank, just under the screw cap. Kept there, it's safe, easy to get the very moment you need it, and can't rust.—*Andrew Vena, Philadelphia.*



Chisel Rack Protects Edges

FINE cutting edges of wood-turning or straight chisels are protected if the tools are hung in the double-shelf rack above. The holes in the two shelves are identical, and are bored oversize to permit easy insertion and withdrawal of the chisels. Both shelf members are simply butted against a back, or could be mounted on a wall or cabinet.—*D. J. Bachner, Jackson Heights, N. Y.*



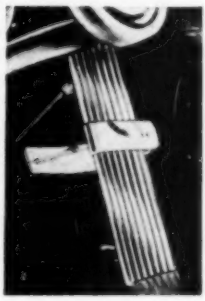
Gears Work Offset Screwdriver

DURING the war this simple tool gave good service at a plant turning out important military equipment. Not only will it drive screws in tight quarters, but if fitted with a countersink, it'll also deburr holes you couldn't reach with an ordinary drill.

Select the gears first and build the gadget around them. The dimensions shown were for ⅜" miter gears ⅛" thick. Square up one side and end of a piece of bar steel or dural. Locate the shaft holes and gear slots from these trued sides. Be careful to drill the holes at right angles. Drill both shafts for pins to lock on the gears, and shape the short one to a screwdriver bit. Harden it for greater durability.—*Edward J. Carey, Brooklyn, N. Y.*

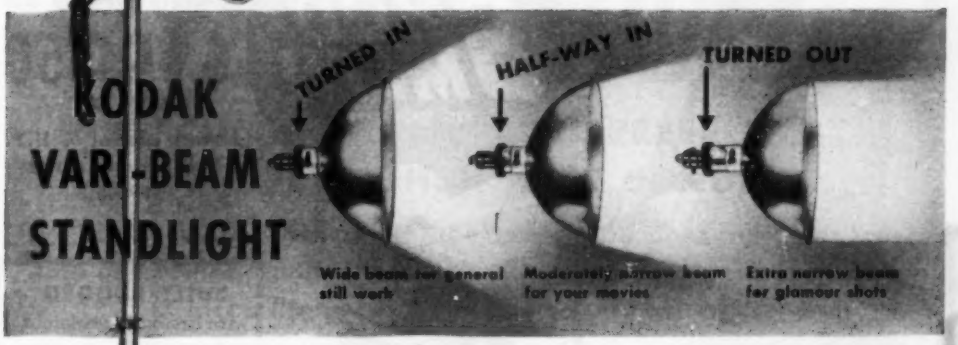
Spring Limits Speed of Car

INSTALLED on the accelerator, a spring clip made by Speed-Minder Laboratories, Chicago, resists foot pressure at a predetermined speed, reminding the driver to stay in that limit. Adjustable for various speeds, it allows full throttle in emergency.



PUT SNAP AND SPARKLE IN YOUR NIGHTTIME PICTURES

KODAK VARI-BEAM STANDLIGHT



FEATURES

12-INCH REFLECTOR . . . with No. 2 Photoflood lamp, gives powerful illumination.

FIRM STEEL BASE . . . 4½ pounds, has special rubber rim for protecting furniture and floors.

TELESCOPIC COLUMN . . . easy to adjust lamp for any height from 3 to 5½ feet.

CONVENIENT HANDLE FOR AIMING LAMP . . . clamping knob quickly adjusts tension.

Price—$15

KODAK VARI-BEAM CLAMPLIGHT—
Lamp unit has all the features of the Vari-Beam Standlight unit, but is mounted on flexible bracket. Padded clamp attaches quickly and securely to chair backs, table tops, and tubular surfaces.

Price—**$9.75**

Prices subject to change without notice

KODAK PHOTO FLASHER—
Brilliant indoor flash pictures are easy to take with this self-contained unit. Specially designed for any camera with "time" or "bulb" setting. Simply open shutter . . . shoot the Flasher . . . close the shutter, and you have the picture.

Price—**$1.25** *(plus tax)*

"Kodak" is a trade-mark

EASTMAN KODAK CO.
ROCHESTER 4, N. Y.

Kodak

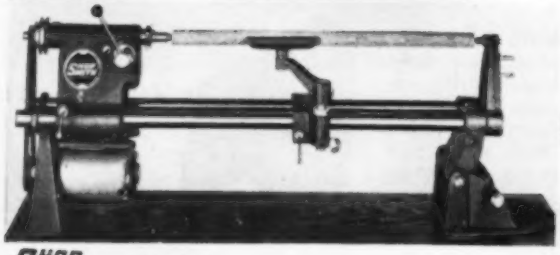
At Last! THE POWER

SHOP SMITH
REG. TRADE MARK

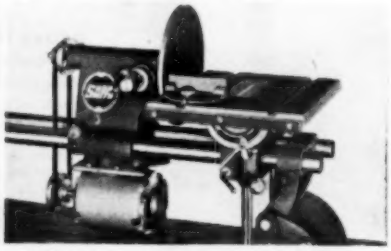
Complete five-tool unit
$159.50
...with special ½ H.P. ball bearing motor $195.50

BUILT RUGGED
with cast iron headstock and carriage. Centerless ground and polished steel ways. Heavily-ribbed aluminum table. Four life-long grease-sealed Fafnir ball bearings. Unit weighs over 200 pounds. Will last a lifetime.

SHOP SMITH AS A CIRCULAR SAW
Has maximum distance of 46" between saw blade and fence. Tilts to any angle—positive lock. New principle provides micro-adjustment of distance between fence and saw blade.
Specifications: Saw Blade: 8" Dia. Depth of cut: 2¼". Table: 14½" x 17"; with extension, 34" x 17".
Standard Equipment: 8" saw blade and arbor. Table extension. Mitre gauge. Rip fence. Saw guard.



SHOP SMITH AS A LATHE
34" between centers. Swing: 15". Variable speeds. Quill Feed: 4½".
Standard Equipment: Tool rest. Drive center. Dead center.

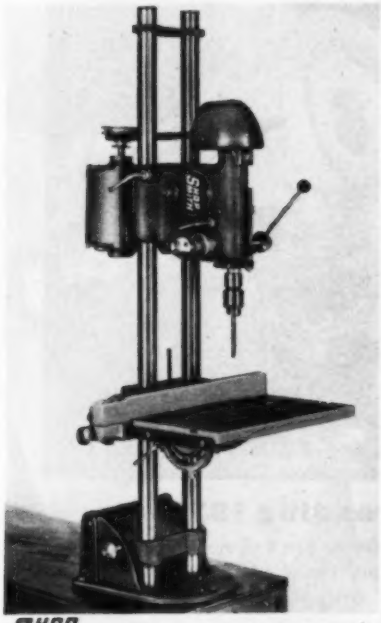


SHOP SMITH AS A DISC SANDER
Disc Diameter: 12". Table Dimensions: 14½" x 17" Tilting Table.
Standard Equipment: 12" disc. Mitre gauge.

TOOL YOU'VE ALWAYS WANTED

CIRCULAR SAW • DRILL PRESS VERTICAL AND HORIZONTAL
WOOD LATHE • DISC SANDER

Five Sturdy Tools...each better than a single-purpose tool—engineered into one compact unit. Thousands already in use. Is rugged enough to last a lifetime. And priced so you can afford it

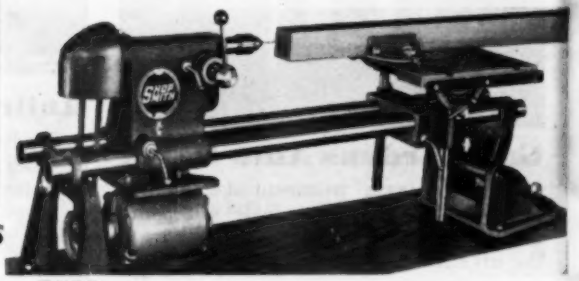


SHOPSMITH AS A VERTICAL DRILL PRESS
Capacity: Drills to center of 15" circle. Clearance: Table to chuck—27" max. Spindle: ⅝" Dia., 6 spline, hardened tip. Spindle Feed: 4½". 4 grease-sealed Fafnir ball bearings. Variable speeds. Table: 14½" x 17".
Standard Equipment: ½" Jacobs key chuck. Fence.

SHOPSMITH — built for man-size work — is no toy. Compact (59" long by 21" wide by 18" high). Shopsmith weighs over 200 pounds. There's an *8" combination circular saw* that cuts 2¼" deep . . . *big capacity lathe* with 15" swing . . . accurate *12" disc sander* . . . *horizontal drill press* with no limit to work length . . . *vertical drill press* with ½" capacity Jacobs key chuck. Shopsmith also excels as grinder, buffer, drum sander, router. And you can change from tool to tool in less than one minute!

Demand, of course, is ahead of production. But Shopsmith will soon be available to the thousands of craftsmen who have long demanded a compact, sturdy multi-purpose power tool. Your wait will be rewarded. Magna Engineering Corporation, 465 California St., San Francisco 4.

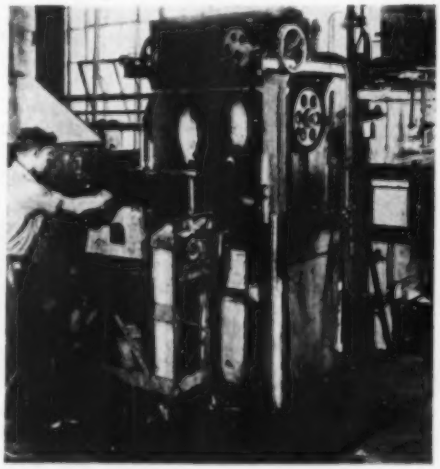
SHOP SMITH
REG. TRADE MARK



SHOPSMITH AS A HORIZONTAL DRILL PRESS
Only Shopsmith performs this highly useful function. No limit to length of work. Provides accurate method of drilling for doweling, etc.

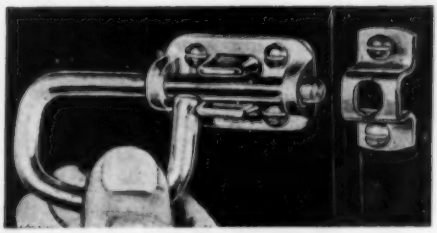
Waste Whisked Away

THIS San-i-Way Ⓣ waste container holds a disposable, water-repellent, waxed-paper bag in a steel framework. Toe pressure on a pedal opens the bag for receiving garbage, or releases it for removal. It is made by LeRoy Products, of Ypsilanti, Mich.



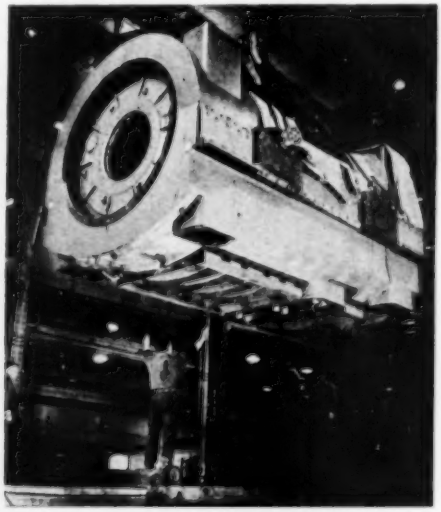
Gas Hardens Auto Parts

A "DRY CYANIDE" treatment of small auto parts, replacing liquid cyanide salt baths, gives the parts longer life. Shown above is the dry-cyanide-gas furnace at GM's Oldsmobile Division. Small parts, such as brake-lever pawls and shift levers, are case-hardened at between 1,475° and 1,550° F. and exposed to the gas. An oil bath follows.



New Latch Is Safer

THE weight of the latch handle of the new door and window bolt lock shown above makes it fall automatically into a fixed and locked position at all times. The manufacturer, Hall Industries, of Chicago, Ill., claims that this feature makes their Handle-Latch Ⓣ practically jimmyproof. The hole in the center of the bolt receiver makes it possible to attach the device in two positions: either in the regular way as illustrated here, or turned facing the bolt, with the hole as the bolt receiver.



Railroading 185 Tons

THE heaviest piece of electrical equipment ever shipped out of a GE plant, the external generator case, shown above being loaded on a special flatcar, weighs 369,500 lb. It is part of a turbine-generator set that will produce enough power for a city of 200,000. To clear a bridge at one point en route to its New Jersey destination, railroad tracks had to be sunk five inches. A normal two-day trip took six days.

NOW... LIGHT WHEN YOU NEED IT!

Ray·O·Vac LEAK PROOF batteries stay fresh for years!

(because they're sealed in steel!)

© 1946 BY RAY-O-VAC COMPANY, MADISON, WIS. RAY-O-VAC (LIMITED) CANADA, WINNIPEG, MAN.

Foiled—these tricky power thieves,
Causing all your flashlight peeves.

Modern, steel-sealed Ray-O-Vacs
Stop these gremlins in their tracks.

Power's locked in, and that is why
Spares stay fresh. How's *your* supply?

Guarantee: If your flashlight is damaged by corrosion, leakage, or swelling of this battery, send it to us with the batteries and we will give you FREE a new comparable flashlight with batteries.

Ask for Ray·O·Vac Leak Proofs

Buy Spares... *they stay fresh*

Deep or shallow? Crisp or damp? Falling straight down or angling in at 80 miles an hour?

No joke! The Army Signal Corps has push-button weather the whole year round — and right at Fort Monmouth, New Jersey!

These versatile Army weathermen don't stop at mere blizzards. In their new equipment torture-chamber, they can yank the temperature down to an unearthly 100 degrees below zero or boost it to a broiling 190 degrees above. They can make rain like a Rangoon monsoon, hail like cherrystones, fog like London's, hurricanes and typhoons and desert dust storms like nothing civilized man has ever seen!

Here's the recipe for snow. In a chamber the size of a 4-room house, they yank the temperature down to minus 40 with huge ammonia compressors powered electrically with 700 horsepower. Then they shoot in saturated steam which quickly turns to fog and drops to the freezing point where it forms a super-cooled cloud. At 5 or 10 degrees above zero, Signal Corps engineers induce nucleation by shaking a thimble-size bag of dry ice. When the cloud gets down to minus 40, the water vapor crystallizes into billions of snow crystals which fall to the floor or can be blown about with a high-speed propeller.

In a single week, military equipment can be tested in every conceivable kind of weather — testing which otherwise would take many years and millions of dollars to accomplish.

Do you like this sort of forward-looking achievement? Nowhere is science getting a bigger run for its money than in the technical services of the U. S. Army. The ambitious young scientist has his choice of technical schools galore! If you are 17 to 34, ask your nearest Recruiting Officer if you measure up to the Army's high standards.

CAREERS WITH A FUTURE

U. S. Army and U. S. Air Force

U. S. ARMY AND U. S. AIR FORCE RECRUITING SERVICE

Piston Rings wear out, too

and oil pumping is the first symptom

When oil pumping starts, look to your piston rings immediately. Delay can mean a lot of needless grief and expense. Piston rings can be replaced easily and inexpensively. And when you install Hastings rings you *stop* oil pumping, *check* cylinder wear, *restore* engine performance. It's the best money you can spend on your car. Hastings Manufacturing Company, Hastings, Michigan. Hastings Ltd., Toronto.

HASTINGS

STEEL-VENT PISTON RINGS

Tough on Oil Pumping
Gentle on Cylinder Walls

If a "flat" anchors you just over the hill... tonight

Send your wife back to the crest of the hill to flash a warning signal. Equipped with a WINCHESTER ... the dual-purpose light that throws *both red and white* light rays... she can warn approaching cars. Then, in safety, you can change wheels with the aid of the brilliant light from your second WINCHESTER flashlight.

IF ALONE, PUT RED-WARNING LIGHT ON HIGHWAY 50 YARDS TO REAR OF YOUR CAR

Play safe. $3.10, the price of these 2 WINCHESTER flashlights complete with batteries, is inexpensive "life protection" for you, your wife and other travelers.

WINCHESTER BATTERIES
TRADE-MARK

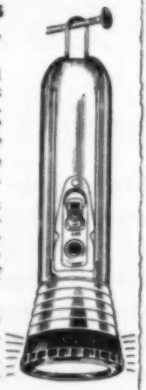
Last almost TWICE as Long!

Still cost only a dime. *But, measured by A. S. A. light industrial flashlight test, the Winchester No. 1511 flashlight battery now LASTS ALMOST TWICE as long as previously. Reason? Research found a way to step up the power of the light-making chemicals.

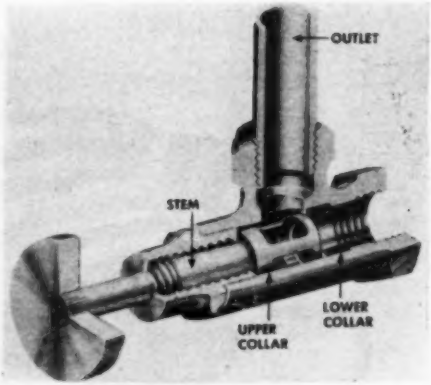
Use them not only in flashlights but also for *any* equipment using regular flashlight-cell size batteries. Winchester Repeating Arms Company, New Haven, Connecticut, Division of Olin Industries, Inc.

(Right) No. 6410 Winchester with hanger; complete with batteries, $1.65.

(Below) No. 4510 Winchester, complete with batteries $1.45. Other Winchester Flashlights at your dealers from 59¢ complete.



WINCHESTER
TRADE-MARK
FLASHLIGHTS AND BATTERIES



Trouble-Free Valve

THE valve seat, washers, and all wearing parts—main sources of trouble in valves—have been eliminated in this new valve. Developed by Knowles-Fisher Corp., it opens and closes with a flick of the finger, and is both jamproof and leakproof. When opened, a highly polished stem is withdrawn from the lower to the upper of two synthetic rubber collars. As pressure builds up gradually, operation is smooth and almost noiseless.

No Shortage of Salt

SIX POUNDS of salt seasons all the food an average American can eat in a year, yet enough salt is produced to supply every person in the world with 40 pounds.

Cooling Hot Miners

IT GETS so hot below the earth's surface (the temperature increases 16° F. every 1,000 feet underground) that the world's deepest gold mine, in Robinson Deep, South Africa, had to be air-conditioned to prevent cremation of the miners.

Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/8"	5/16"
Thread	3/8"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion Spark Plugs for model gas engines give the same dependable performance as regular Champions. Champion Ceramic insulation — Sillment sealed. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION
SPARK PLUG COMPANY • TOLEDO 1, OHIO

Dependable

CHAMPION

America's Favorite Spark Plug

Keep your eye on the track!
Most racing drivers use Champion Spark Plugs because they have found that they insure better, more dependable engine performance. Most motorists have likewise found this to be true—and have made Champion America's Favorite Spark Plug —*for every engine!*

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

FOLLOW THE EXPERTS

DEMAND NEW DEPENDABLE CHAMPIONS FOR YOUR CAR

Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

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...with the "super-imposed-image" Range Viewer

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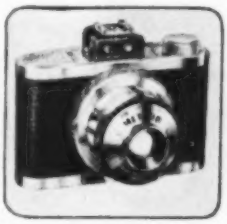
—double frame 35mm. candid with "super-imposed-image" Range Viewer formerly only on expensive imports... yet only...65.00

IT sure IS a honey . . . this Universal Buccaneer: The slick, double quick Range Viewer finds your range and composes your picture in a single look.

It goes into split-second action . . . takes "out of this world" color shots, indoors or out; brilliant black and white on dull days or bright. Its shutter release automatically locks against double exposures. No more wasted film or picture disappointments.

It's only the Buccaneer that combines all these features: coated f3.5 lens for all-purpose use; built-in flash synchronizer . . . versatile shutter speeds: 1/10th to 1/300th, time and bulb; built-in extinction type exposure meter with calculator. See Universal's Buccaneer—the camera that experts endorse.

UNIVERSAL CAMERA CORPORATION
New York, Chicago, Hollywood



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"The greatest candid for color." 35 mm. single frame. Extreme depth of focus, coated f2.7 lens, speeds to 1/1000th sec. 82.90

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Choice of experts in every art and craft field. A blade for every purpose—quickly interchangeable. Singly and in sets, 50¢ to $50.00.
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In your own workshop allows you to design and build your own GASOLINE ENGINES, STEAM ENGINES, STATUARY, ART OBJECTS, SPECIAL TOOLS, NEW INVENTIONS, ETC. You can also make forgings and case harden steel. Your shop is not complete without a FOUNDRYETTE. Three sizes are available capable of making bronze castings of 1½, 3 and 6 pounds weight, aluminum, copper, brass, etc., $22.50, $29.50, $42.00 f.o.b. Kansas City. Domestic gas supply and 110 volt AC or DC energy required for operation. Write for circular.

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AUTOMATIC GRIP
SCREW-DRIVERS

UNSURPASSED QUALITY
Plus the
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Gripper slides up out of way when not in use. Insulating handles. Complete range of sizes.
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Now-A New Kind of Screening

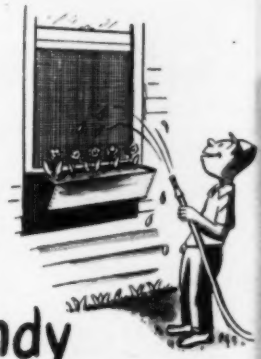
STAINPROOF-RUSTPROOF -LASTS A LIFETIME

Handsome

Good looks are just a part of this amazing new screen material. Because it is absolutely rustproof . . . corrosion proof, LUMITE can *never* stain the sills or sidewalls of your house—*never* become ugly-looking or discolored.

Tough

Here's the screen you would never have believed possible . . that always stays taut and firm! Punch it, bump it, lean on it—it gives—then snaps right back when mounted properly. Lasts as long as your house



Handy

Perfect for the man-about-the-house, LUMITE is the no-upkeep screen. It never needs painting or any protective coating. It's amazingly easy to handle—you can cut it with ordinary scissors . . no special tools. No scratched fingers.

Different

Made from saran plastic, the fibres of this amazing material give LUMITE qualities never before imagined in an insect screen. Imagine—if you can—a screen completely unaffected by water sun, smoke, soot, acid fumes, or salt spray. That's LUMITE! *Sold by leading Hardware, Lumber or Building Supply dealers*

For information and free sample
write Dept. 53, Lumite Division
Chicopee Manufacturing Corporation
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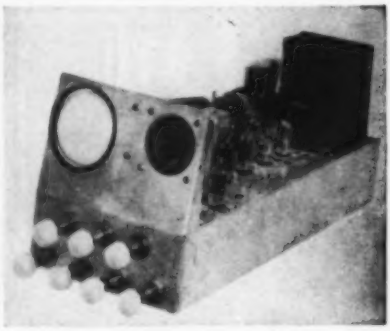
Guaranteed by Good Housekeeping

Screen once and for all with

LUMITE*

Woven of saran



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Designed around modern circuits, and manufactured of the finest materials, this ESPEY Television Kit offers you the opportunity of building your own personal television set at unbelievably low cost. Kit is supplied complete (less tubes and cabinet) with all parts, punched and welded chassis, instruction book, etc. for only... $69.50

Magnifier makes 20 sq. in. picture!

*Prices 5% higher West of Rockies

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Smoother Motor; Easier Starting; Faster Pickup; Slower Idling; with GANE AIR-FLOW NEEDLE for your Carburetor. $1.75 each installed by YOUR Service Station, Garage, Car Dealer on 10-Day Free Trial Money Back Guarantee, or Order Direct. Mail card for Free Data.

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"INDEPENDENT TEST REPORT ON KAISER-FRAZER CARS"

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FASTEST PLANER in the WORLD at this Low Price... $195.00

BELSAW Multi-Duty Planer

Speed up production! Increase your profits! BELSAW power self-feeds at 24 feet per minute...The lowest-priced surfacer that will handle 12 x 6 in. stock. Planes green or dry sawed lumber into smooth, worked forms. Three high-speed steel knives make 42 cuts per inch. Multi-duty BELSAW takes inexpensive attachments for all planing mill operations — Jointing, Rabbeting, Grooving, Matching. BELSAW is the ***only*** 12 in. planer providing ***attachments for jointing and grinding its own knives.*** Start planning NOW for BIGGER VALUE and BETTER PERFORMANCE, with BELSAW. Write for FREE specifications, illustrations and low prices.

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TWIN CYLINDER

Here is power galore for midget racing cars, speed boats, etc., or build your own garden tractor, mower, welding outfit, mill, saw, home lighting plant. Use it for any type of power job. Engines measure 32" long, 22" wide, 18" high. Mounts flat with mounting brackets 14" apart each way.

FOR SHOP, FARM AND HOME POWER

Precision built—orig. acquisition cost many times our asking price. Famous Andover make—replacement parts available. Designed for 3600 max. RPM with 31.91 cu. in. displacement. Full 2¾" bore, 2 11/16" stroke. Dual carburetion with shielded ignition and fuel system. Removable governor included. Each motor is fitted with 28.5 volt generator (removable) ideal for welding outfits.

A RARE BARGAIN AT THIS LOW PRICE

These are built to run like a Rolls-Royce. Slightly used but guaranteed perfect—some like brand new. Guaranteed as described or your money back. Your cost, each, only $119.00—two or more, $110.00 each while they last. Send check or money order. You've seen our ads since 1941.

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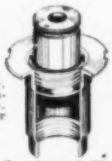

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Blade snaps on—Stays put
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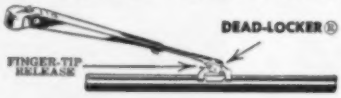

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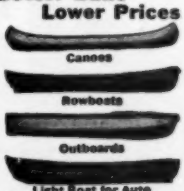

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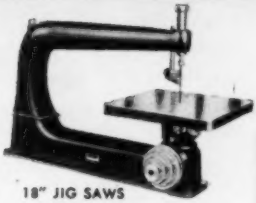

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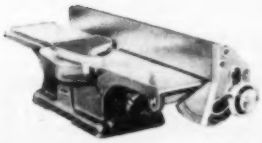

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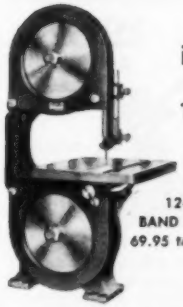

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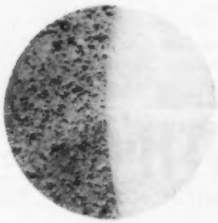

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THE BRUSH WITH THE STEEL BACK

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Sweeps cleaner, faster— Out lasts ordinary brushes 3 to 1!

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Size Inches	Polished 2 Blade	Polished 3 Blade	Unpolished 2 Blade	Unpolished 3 Blade	Bore Inches
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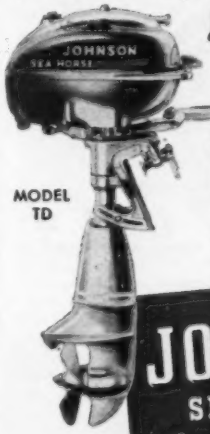

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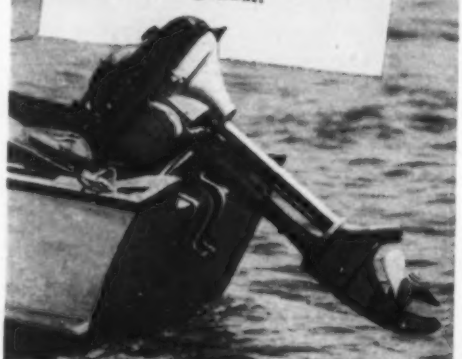

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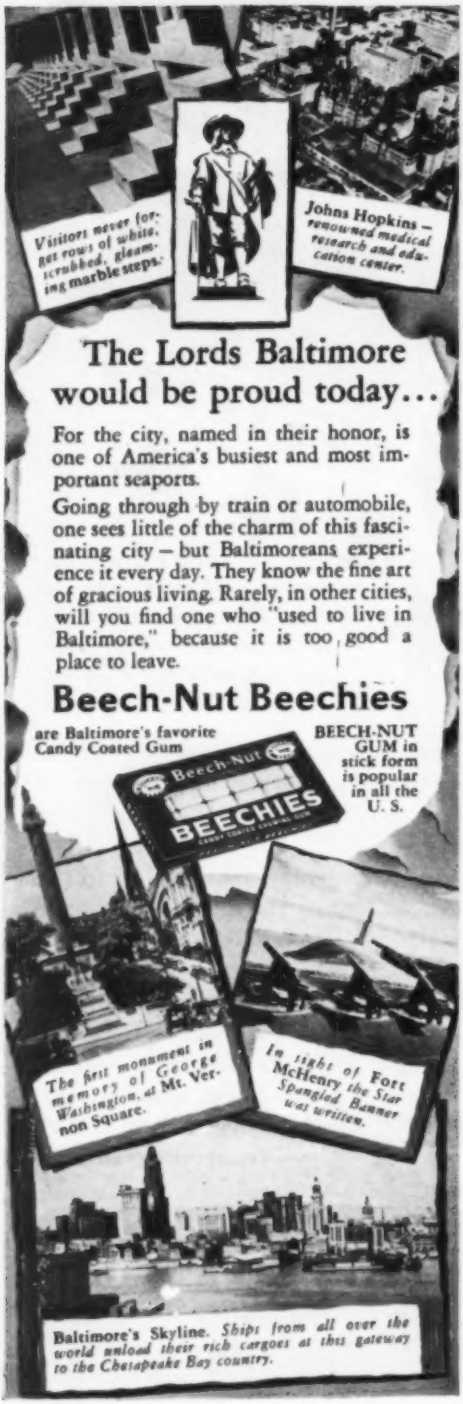

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CARNU cleans
as you rub it on

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Get Johnson's Carnu at service stations, auto supply, hardware, department, grocery or variety stores.

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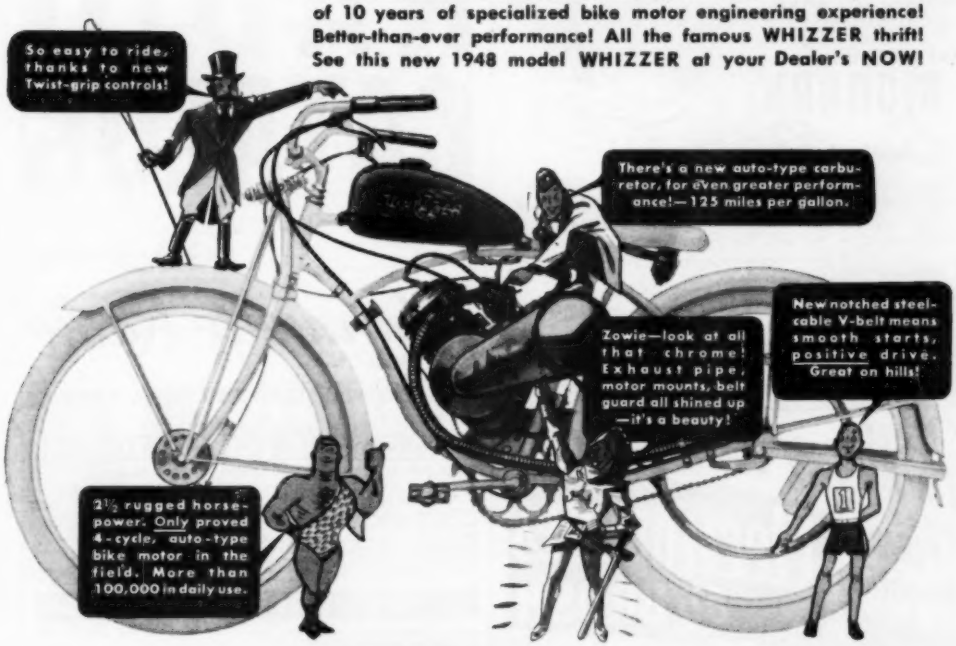

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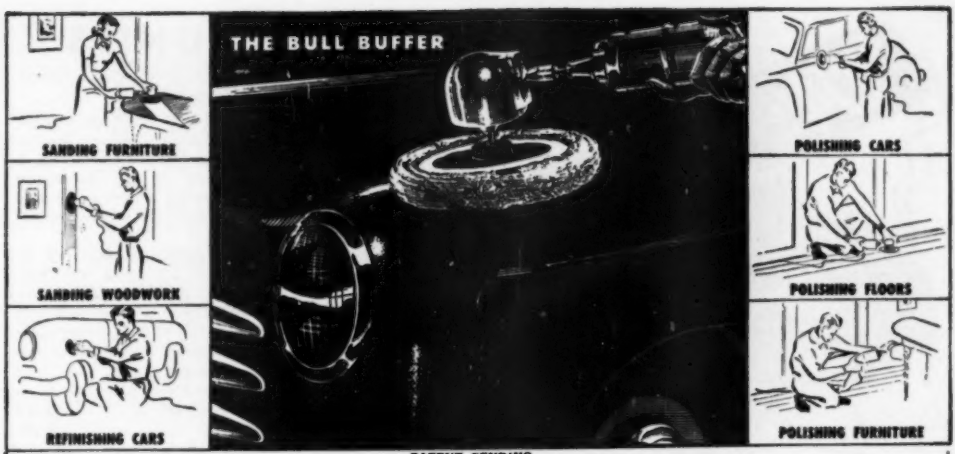

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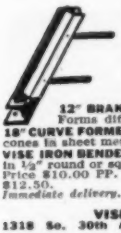

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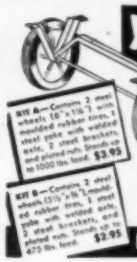

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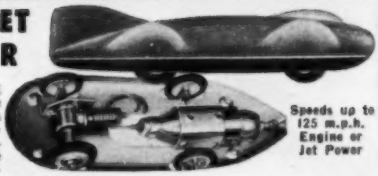

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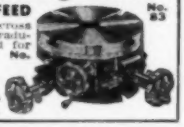

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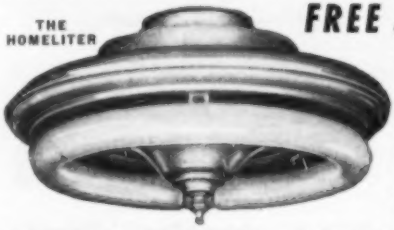

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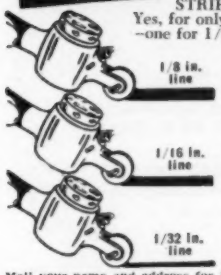

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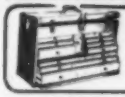

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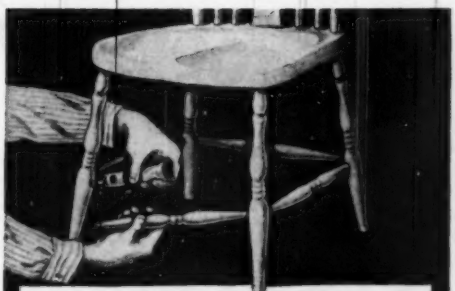

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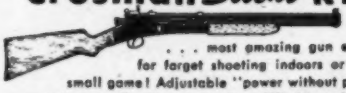

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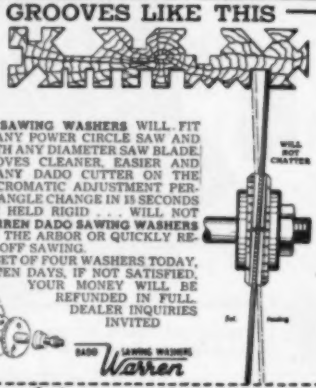

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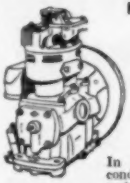

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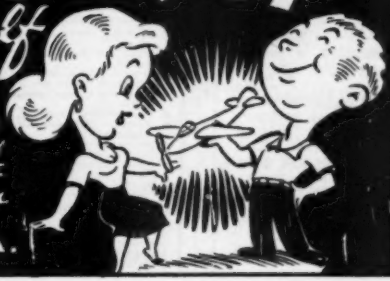

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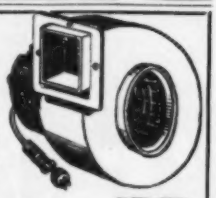

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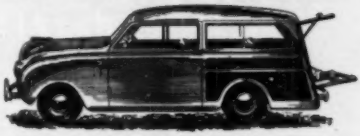

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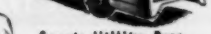

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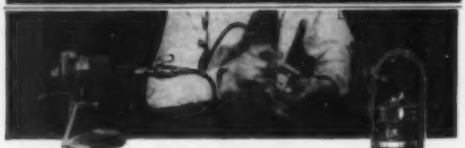

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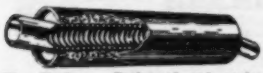

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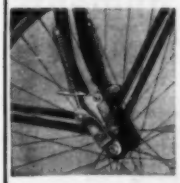

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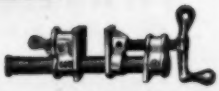

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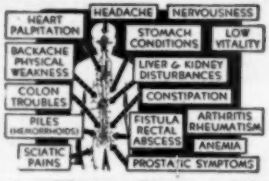

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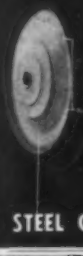

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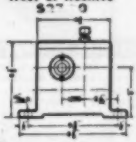

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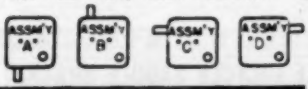

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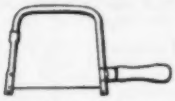

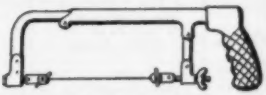

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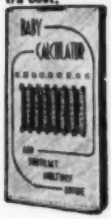

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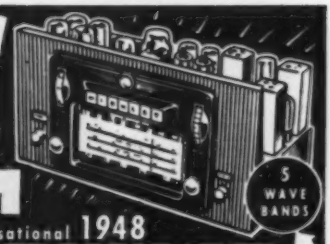

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With Laminated Fibre Board Drawers

THE HANDY WAY TO KEEP SMALL PARTS, WASHERS, NAILS, SCREWS, NUTS, BOLTS AT HAND

Approximate
DRAWER SIZE
1¼" Deep
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6" Long

CABINET SIZE
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6" Deep
12¾" Wide
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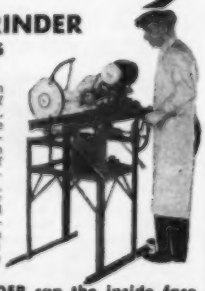
PUTS YOU INTO BUSINESS WITH SMALL INVESTMENT



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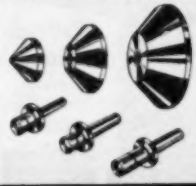

Fit head or tail spindles. Centers revolve on shank.

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HIGH	7.25:1	50	5800
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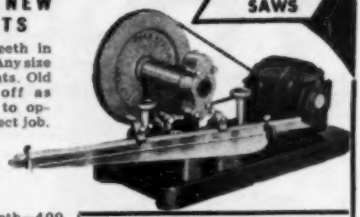

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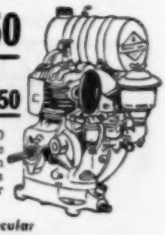

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Mail Orders Promptly Filled • Shipped C. O. D. or send check or money order.
Address mail-orders to: ADLEW JEWELERS (Dept. PS-6), 152 West 42nd St., N.Y.C. 18.

Also available in 18-k Gold Case. $44.50 (plus 10% tax), formerly $125.

TINY RADIO FITS IN YOUR EAR!

ABOUT NICKEL SIZE! Wt. 1 oz! AMAZING TINY but contains CRYSTAL DIODE AND ALNICO PHONE, RECEIVES LOCAL RADIO BROADCASTS by simple connections. USE MOST ANYWHERE IN OFFICES, HOTELS, CABINS, SCHOOL, BED, etc. Should play for years.

SEND NO MONEY Just pay postman $2.99 plus COD postage on arrival. Order your ear-radio—Today—Now!

PAKETTE PRODUCTS CO., DEPT. EPS-6, KEARNEY, NEBRASKA

It's EASY! ECONOMICAL!

Build Your Own Trailer with NATIONAL'S Simplified Plans

Beat the housing shortage with a full-size house on wheels or add new pleasure to your vacations and week-ends with a sleek sport trailer. Step-by-step instructions and complete bill of materials with every plan. *Three different models.*

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Big parts catalog FREE with any order! FREE!

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Made in accordance with U. S. Army Specification 20-23-G (Type 1) and U. S. Navy Specification 49 C 1. Clean fresh stock. 5/8" dia. contains about 500 strands of live rubber, 3/8" about 100 strands, 1/4" about 40 strands. Sold in lengths of 25 feet or more.

Dia.	Per ft.	Per 25 ft. length
1/4"	4c	$1.00
3/8"	5c	1.25
5/8"	7c	1.75

The 1/4" length is ideal for exercise cord in flexibility. The heavier lengths have a thousand uses.

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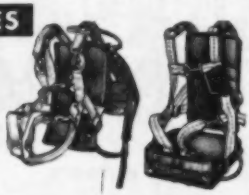

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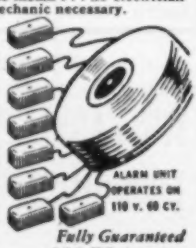
Last year nearly 12,000 people were killed in the U. S. by fire . . . over 2,000 of these were children under five.

Now you can protect your loved ones . . . save your property with this inexpensive fire alarm system . . . and it is simple for you to install . . . no electrician or mechanic necessary.

● Hang attractive alarm like electric clock in any room, plug into nearest socket. Alarm unit (only 7" diameter) contains: relay, transformer, and compact automobile-type horn of precision build. Mount 8 fire detectors in home danger zones. Connect these in closed circuit to alarm with provided wire. Fire detectors contain replaceable units which melt before 170°F., breaking circuit and sounding alarm. Complete equipment includes: 250 ft. fine, insulated wire, screws and staples . . . nothing more to buy. For homes where there are danger areas of up to 2000 sq. ft. Circuit uses no more electricity than a large flashlight.



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SAVE $64.00 AND UP!
Pneumatic Air Tools

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Squeezer and Compression Riveter

Model PRS-10, Alligator jaws, or PRS-10, "C" Type Yoke. Weight 5 lbs. List Price $93.00 — Special Price **$12.95**

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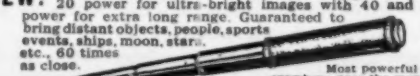

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NOTE: These glasses are surplus property of U. S. Air Forces.

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Spec. No. AN-6531 (none genuine without this spec. no.). 6 base lenses precision ground by Fischer, Bausch & Lomb and American Optical. $10.00 value. Complete with case. prepaid $4.95

Air Force "Type" Sun Glasses $1.98

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Delta Extra Heavy Duty

Water-tight, practically indestructable. Uses 2 standard No. 6 dry cells. 800 ft. beam. Bulbs included. Wt. 5 lbs. $8.00 value. $3.95 less batteries

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Brand new. Lights instantly burns white or leaded gasoline. Handiest stove made. $10.95 value. $7.95 Wt. 4 lbs.

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Light weight waterproof nylon. Zippered side door and window. Rubberized floor. Aluminum poles and stakes. Insect screen. Sleeps 1 or 2. Carrying straps included. Compact. Wt. 21 lbs. Govt. cost $30.00 $9.95

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Brand New. Air force flying goggles. Metal frames, rubber face piece, adj. nose pc. Precision ground lenses. Government cost $7.20. $1.98

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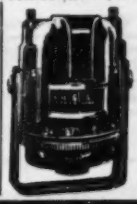

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Precision compass by "Sherrill". Easy to compensate, equipped with site lite, excellent for planes, cars, boats, trucks, etc. Easily mounted. Instruction manual and calculator included. $25.00 value. $5.95 prepaid

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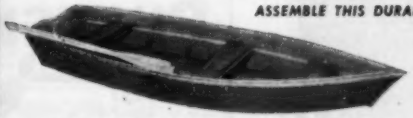
Complete, Ready-Cut **PLYWOOD BOAT KIT $54** (Freight Paid)



ASSEMBLE THIS DURABLE, WELL-DESIGNED 12 FT. BOAT in 8 hours without forms or special tools. Kit includes all hardware, paint. (Less oars.) *Send for Free Folder.*

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We will include not one but two sets of telephones with two rolls of wire complete with push button and buzzer for signaling all for the price of..... $9.95 F.O.B. N.Y.C.

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REMEMBER this equipment cost many times the price you are paying.

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SMALL AS A PACKAGE OF CIGARETTES Wt. only 4 oz.—**BEAUTIFULLY** molded silver black case. **NO TUBES—BATTERIES OR ELECTRIC "PLUG-INS" NEEDED!** Uses **NEW Type** fixed power crystal diode. ONE YEAR SERVICE GUARANTEE.

GUARANTEED TO WORK on local stations if used as directed. **Listen at horse, in cabins, in bed, on farms, hotels, offices—most anywhere.** L. S. of Texas says "It's Wonderful!".

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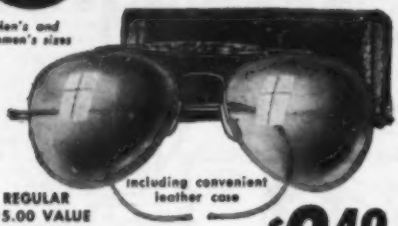
Men's and Women's sizes



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for 2x2 slides

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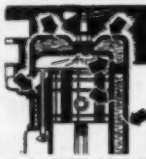

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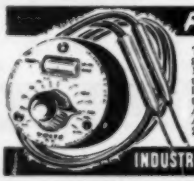

Turn that knob. Extinguish the neon glow. Instantly read voltage off dial. MINI-VOLT model 400B measures 65 to 660 V. AC. Also DC. Tells AC or DC. Virtually burn-out proof. Guaranteed for 10,000 hours. 12" test leads. A "must" in electrical and radio work. At dealers or postpaid $2.50. (C.O.D. 25c extra.)

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... for dogs. Kills fleas and lice quick. Keeps fleas off 5-7 days. Many home uses.

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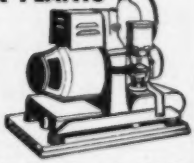

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1-10 inches, 35c per lb.

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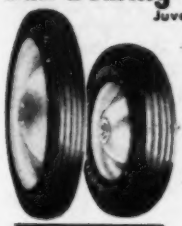

Juvenile wheels, solid tire—No Bearings

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12 x 1.75".....$3.25
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Industrial wheels for heavy loads
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400 x 8, 2 ply tire and tube $12.50
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Exclusive Feature:
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Made according to Government standard. Full size 61mm lenses, ophthalmic ground 4-base curve, shuts out more than 96% of the ultra-violet rays. Adj. nose piece, pearl sweatband, 24k g.p. rims. Handsome leatherette case. Add 8c postage.

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USED - PERFECT SIZES - 13 to 15

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Khaki SUN TAN SHIRTS BRAND NEW
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Brand new. Pants made of 8 oz. and shirts of 6 oz. mercerized khaki suntan twill materials. Well tailored. Add 5c per garment postage.

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ANYONE CAN INSTALL IT . . . QUICKLY!
FITS ANY TYPE OF SEWING MACHINE!
Convert your *old* sewing machine into a *modern electric* sewing machine . . . at a fraction of the cost of a *new* machine.

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Please rush your kit at $16.75. The make of my machine is ..... Handwheel turns: ☐ towards me ☐ away from me.

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Sells for only $19.95. You earn up to $10.00 on every machine.

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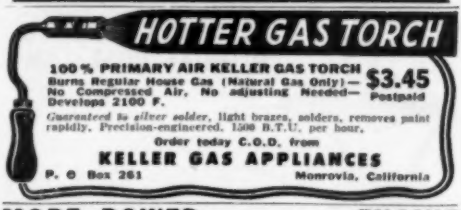

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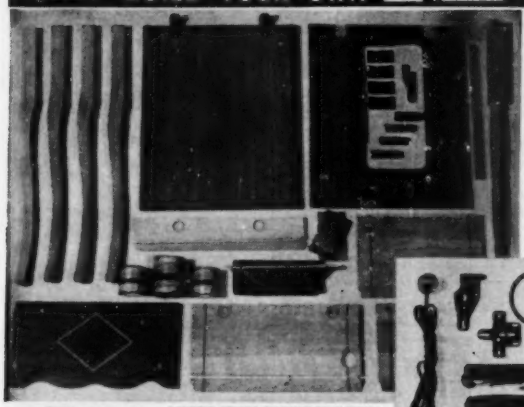
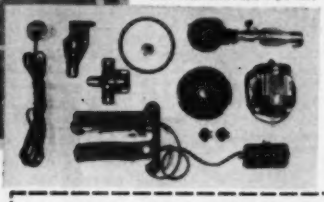
INSTITUTE of MENTALPHYSICS, Dept. 276-G
213 South Hobart Blvd., Los Angeles 4, Calif.

New! BUILD YOUR OWN *complete* ELECTRIC SEWING MACHINE!



YOU get everything—YES EVERYTHING—you need! Surprise your wife or mother by transforming her backbreaking treadle machine into a beautiful, modern, easy stitching ELECTRIC MACHINE that will fit in with the finest furniture. In addition you may save up to $125.00 over a new machine! This is not a flimsy kit. It is crammed full of exciting beautifully grained genuine walnut or mahogany lumber core stock and fine selected kiln dried hardwoods all shaped, presanded, drilled, and morticed and tenoned where needed. Difficult bed cut is all done for you ready to drop your present machine in place! Included also is all hardware, hinges, brackets, screws, stain, filler, varnish, full instructions, etc. A total of 103 separate items! All you need to assemble this fine console cabinet is a screwdriver, hammer, and paintbrush. Simple—yet just as much fun to build for novice and expert alike. MONEY BACK IF NOT FULLY SATISFIED.

Complete Console Cabinet Kit..... $32.50
(Electrification Kit separate)



Announcement

This sewing machine kit is but the first in a series of completely new and challenging projects for Hobbyists. In the future, the CRAFTSMAN'S GUILD will bring you other hard-to-get items. By sending us your name and address now you will be placed on our mailing list and receive advance news of all these exciting projects plus price list of special woodworker's items. There is no obligation to buy—so send us your name today!

CONVERT SEWING MACHINE TO ELECTRIC

Any manually operated sewing machine can be converted to a modern electric machine. Easy-to-follow instructions make it simple. Compare part for part with any other kit offered. Save with CRAFTSMAN'S GUILD! Used with Console Cabinet Kit or separately.

THIS IS WHAT YOU GET: See Photo at Right—*Top Row* ● Extension Cord with Plug and *Double Socket* ● Brackets ● Rubber Belt ● Steel Pulley ● *Spotlight with Reflector.*

Bottom Row ● 7 Step Rheostat Foot or Knee Control ● Flywheel (Singer only) ● Universal AC or DC, 60 Cycle Motor ● 2 Male Plugs.

Complete Electrification Unit only $17.95

CRAFTSMAN'S GUILD, Marlboro, New Jersey

CRAFTSMAN'S GUILD, Marlboro, New Jersey PS-6

Please send me:
- ☐ Complete Kit at ..... $49.50 (Cabinet & Electrification Kits)
- ☐ Cabinet Kit Only at $32.50
- ☐ Electrification Unit Only at $17.95

State make of your sewing machine_____

Check Choice of Legs for Cabinet: ☐ Queen Anne—Upper Left of Photo ☐ Turned—Upper Right of Photo

Check Choice of Wood— ☐ Walnut ☐ Mahogany

Send 10% with order, balance C.O.D. plus postage—or Cash and postage prepaid. West of Mississippi add $1.00.

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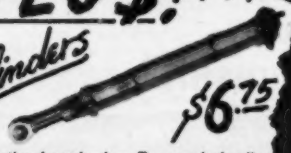
"The Gadget of the Month," Mark-18 Gyro Sight $6.95

The gadgeteers best buy. A truly amazing instrument, and best of all they are brand new in original cartons. Each unit contains a small gyro, a fine optical quality mirror and two superb achromat lens. Besides these, the sight comes equipped with a poloroid filter, a humidity indicator and six additional control units. This is really the bargain of the month.

(Shipped Express - Charges Collect)

Cylinders $6.75



A sensational surplus buy. Two-way hydraulic cylinder, will stand up to 1500 lb. pressure. Overall length 31", with a 2" bore and 18" stroke. The piston rod is 1¼" in diameter and has a bearing type rod end with ⅝" diameter hole. These cylinders have a swivel type mount, and are equipped with neoprene seals so that they will operate on any mineral base oil.

(SHIPPED EXPRESS - CHARGES COLLECT)

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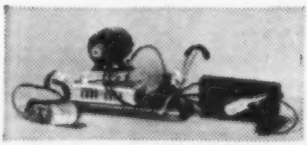

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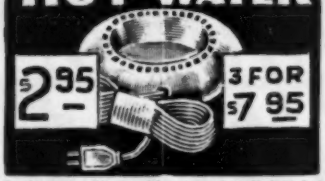

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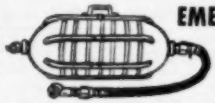

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TO: Reader
FROM: Editor

Right in Your Own Back Yard

THE worst winter in history was deep and white in *our* back yard when we started thinking ahead to this June issue. But it's part of our job to leapfrog seasons: arranging the millions of little pieces that go into Popular Science and printing a million copies of the magazine take time.

We figured this was going to be a tough summer, too. Lot of people with the itch to go—and no place. Lot more cars, but not enough new cars. Not enough room on the old roads to go around. Not enough money, at present prices, to go around.

So, we thought, a lot of people would probably be interested in staying home in the homes they were lucky to have. Now, fun at home is not exactly a new idea. In fact, this magazine has run a number of pieces about it. But this time we wanted something more than dimensional drawings for a back-yard barbecue. We wanted to sell the total idea and the simple principles. We wanted to show *you* how to find your *own* ideas right in your own back yard.

First we talked it over with Arthur Bartlett, a handy man with an idea himself. He and the whole editorial staff began puffing out possibilities like popcorn. Then artist Ray Quigley got into the act. In no time, we had more suggestions than we could cram into a whole issue. The story began to spread like the smell of a steak.

As a result, we got more than an article: we got a cover feature. And I'll bet a steak to a frankfurter the Bartlett and Quigley families, at least, will have more fun at home this summer.

The pictures are certainly as idyllic as a resort folder. The cost ranges from a few bucks to a few hundred—but you can be sure it will be less than a hotel bill.

Like the PS April article, "10 Easy Ways To Get That Extra Room," the piece about Back-Yard Resorts begins with what you've *got* and what you *want*.

What do you need for a family recreation center?

. . . a feeling of privacy—that means a fence.

. . . food facilities—that means anything from a tray of hamburgers to an electrified barbecue pit.

. . . sun and shade—that means a blanket under a tree or a complete outdoor living room.

. . . game facilities—that means what you like, but reduced to minimum terms.

. . . play space for children—that means maximum separation, but under your eye if out of your hair.

. . . water, from a sunken wash basin for the kids to a pool for yourself.

These are the basics: you mix them to suit your yearning and spending ability.

Our story shows how these basics can be combined, and how some can do double duty, like the low-built play and sun table that needn't be rushed out of the rain, and isn't so much trouble to set up that you never use it. This and some kind of screen are all you may need. It's a bench when you sit on the edge to eat, a game table, or a sunning platform.

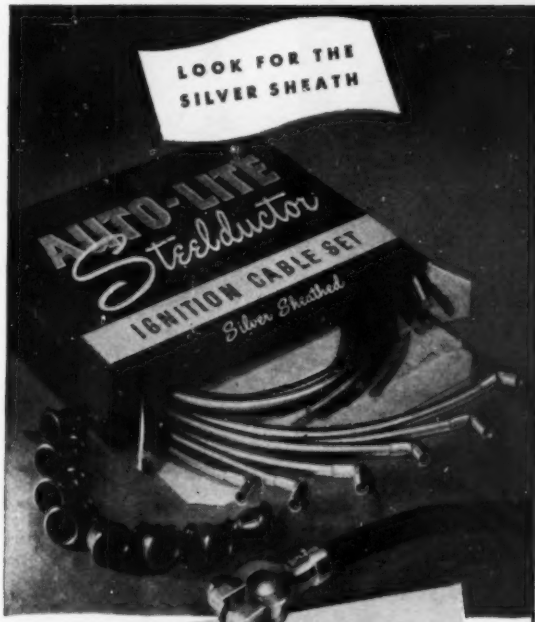
But the big idea of this PS piece is not to give you ideas, but to show you how to find your own.

Happy homing!

PG

WHEN Winter Weary WIRE NEEDS REPLACING

Switch to AUTO-LITE



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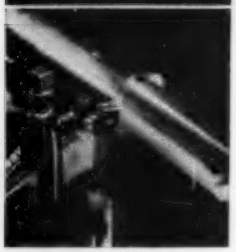
TURNING

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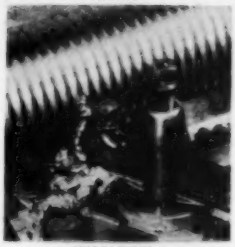
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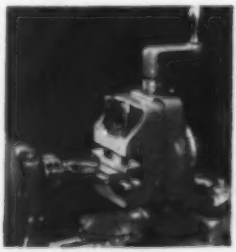
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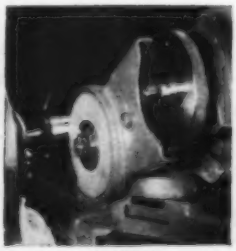
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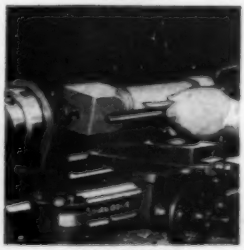
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MORE DOCTORS SMOKE CAMELS THAN ANY OTHER CIGARETTE

Three leading independent research organizations asked 113,597 doctors what cigarette they smoked. More doctors named Camel than any other brand!

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